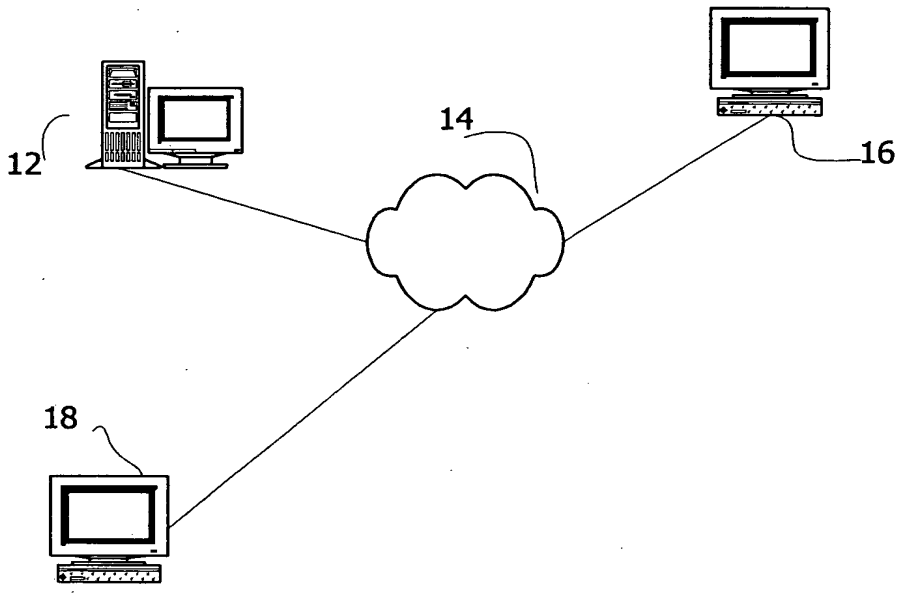


FIG. 1A

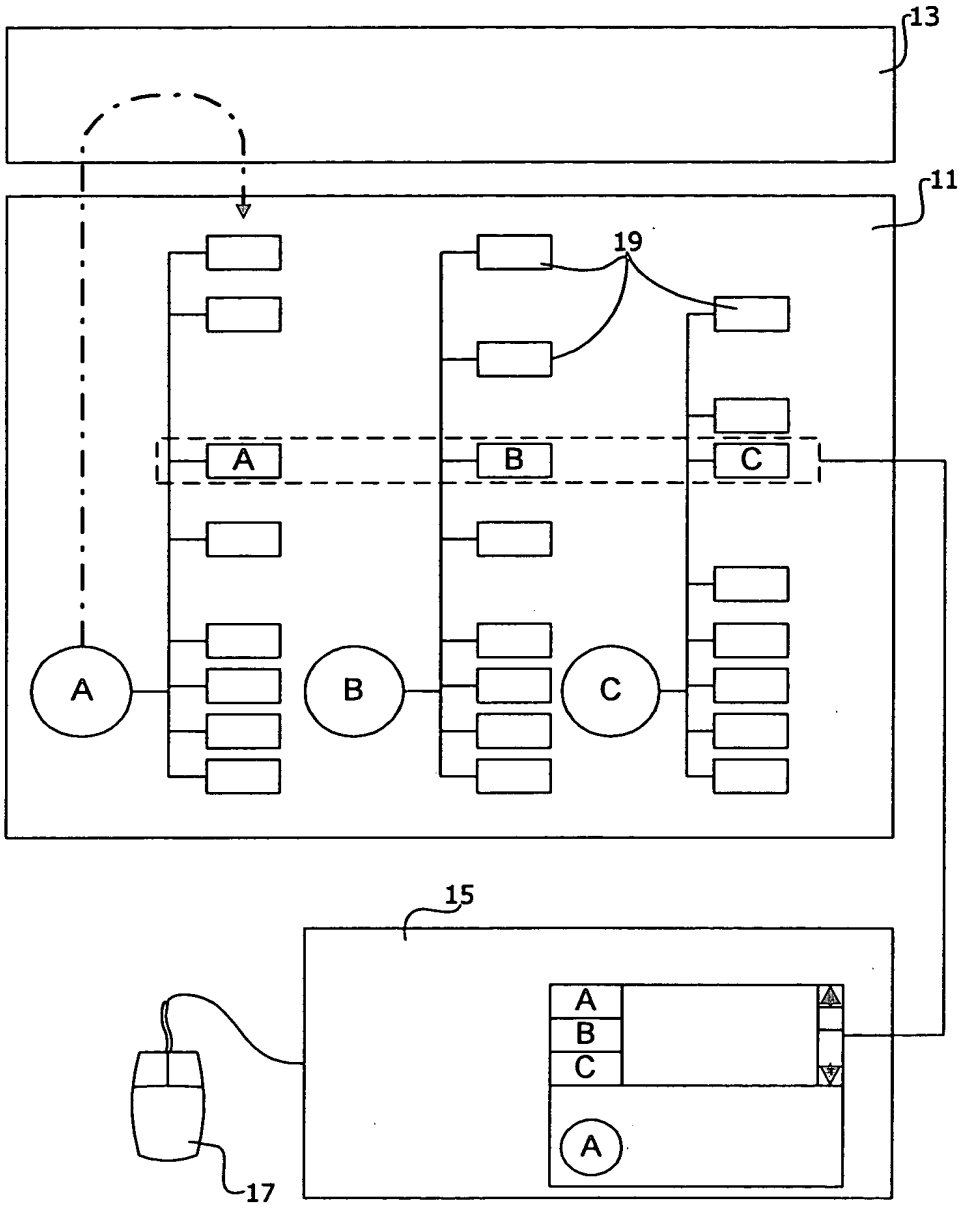


FIG. 1B

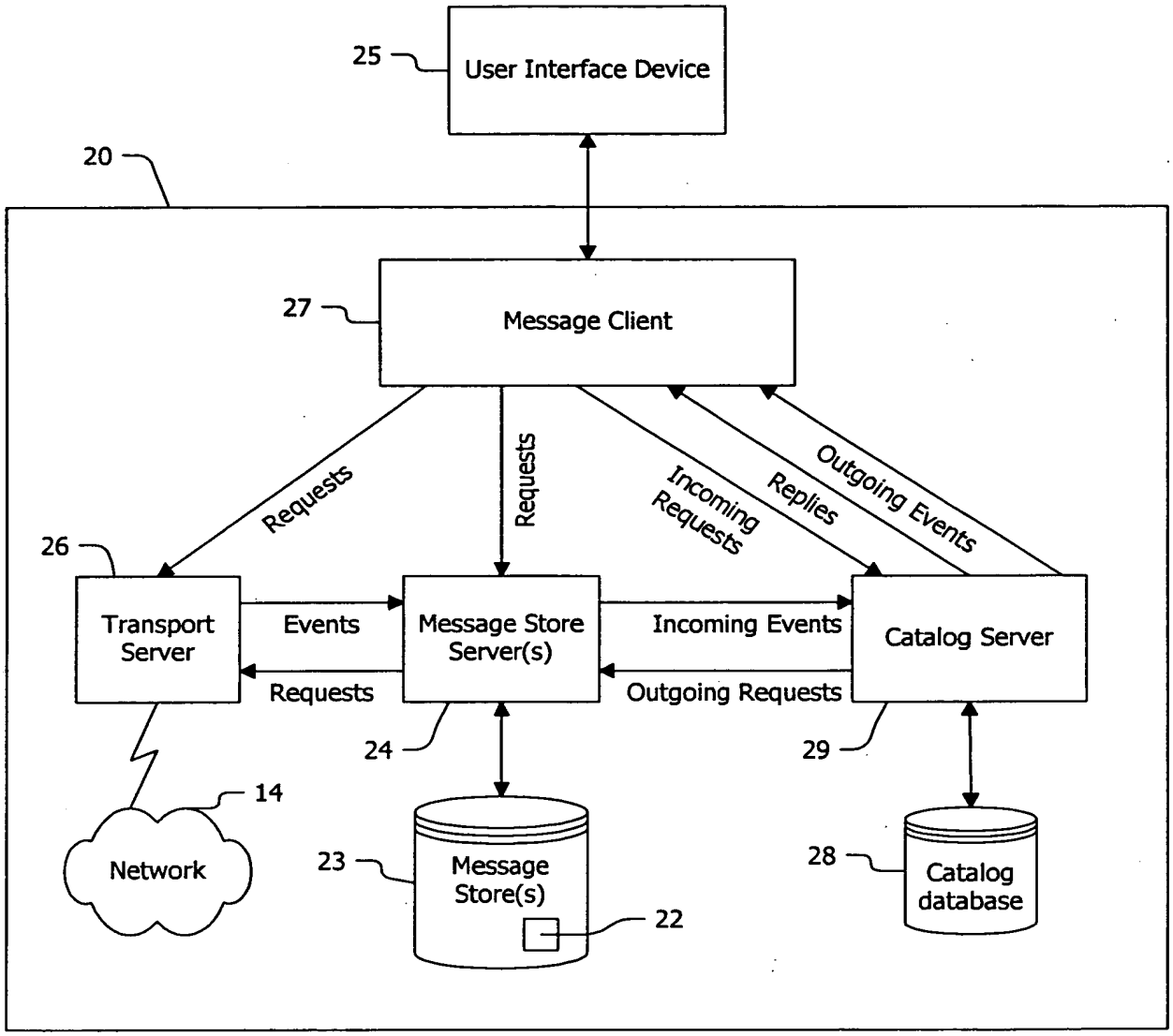

25
User Interface Device
20
27
Message Client
Requests
Requests
Incoming Requests
Replies
Outgoing Events
26
Transport Server
Events
Requests
Message Store Server(s)
Incoming Events
Outgoing Requests
Catalog Server
24
29
14
Network
23
Message Store(s)
22
28
Catalog database

FIG. 2

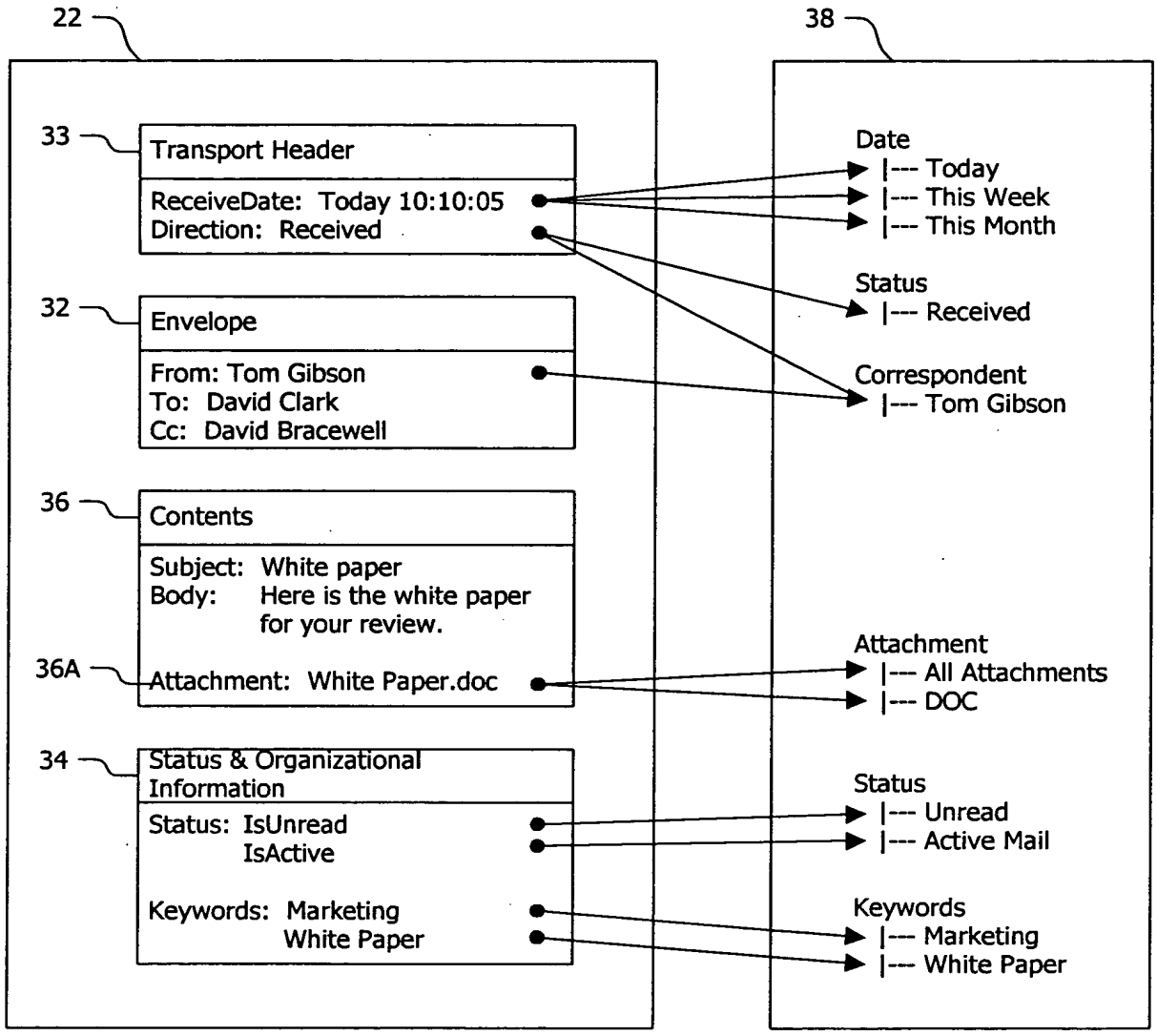

22
38
33
Transport Header
ReceiveDate: Today 10:10:05
Direction: Received
32
Envelope
From: Tom Gibson
To: David Clark
Cc: David Bracewell
36
Contents
Subject: White paper
Body: Here is the white paper for your review.
36A
Attachment: White Paper.doc
34
Status & Organizational Information
Status: IsUnread
IsActive
Keywords: Marketing
White Paper
Date
|--- Today
|--- This Week
|--- This Month
Status
|--- Received
Correspondent
|--- Tom Gibson
Attachment
|--- All Attachments
|--- DOC
Status
|--- Unread
|--- Active Mail
Keywords
|--- Marketing
|--- White Paper

FIG. 3

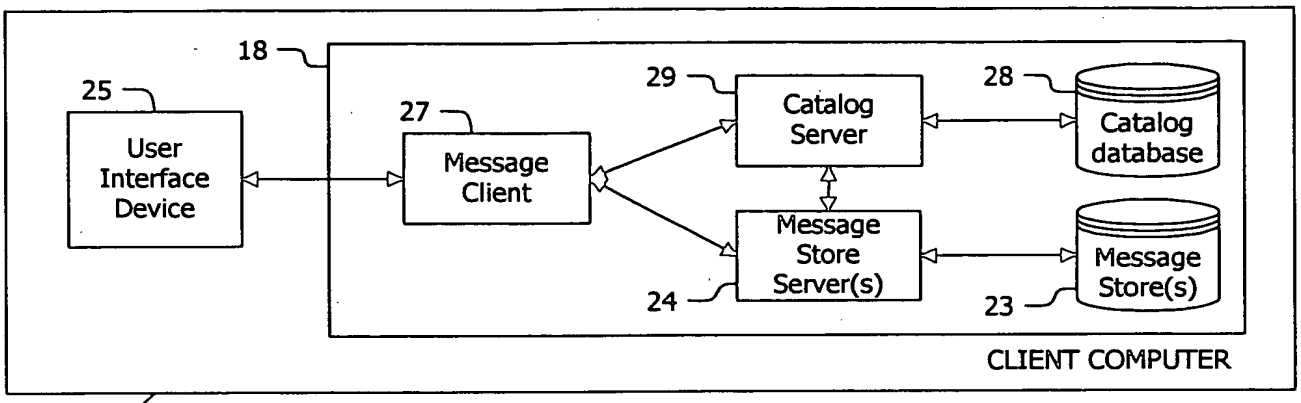


FIG. 4A

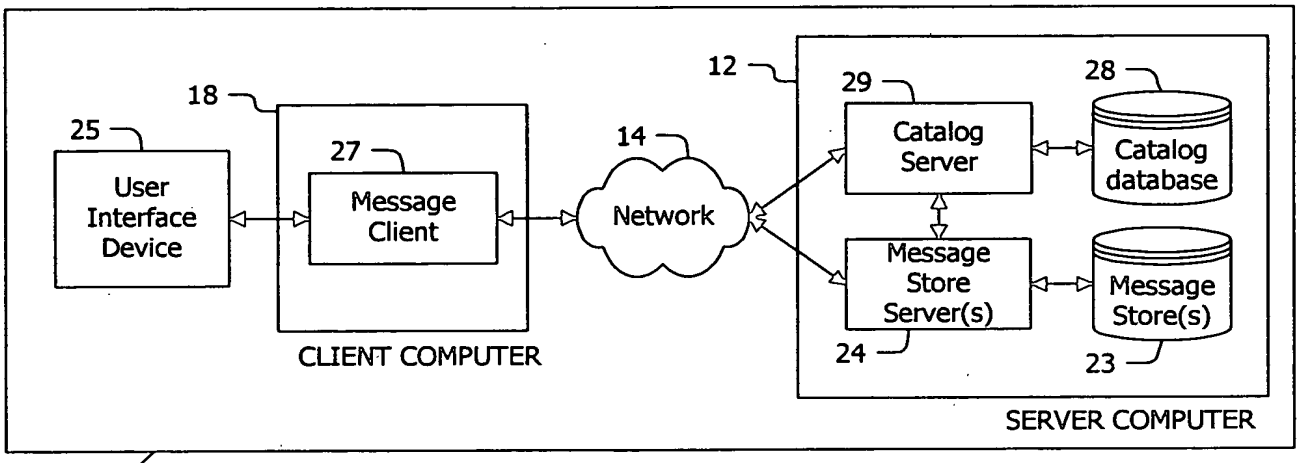


FIG. 4B

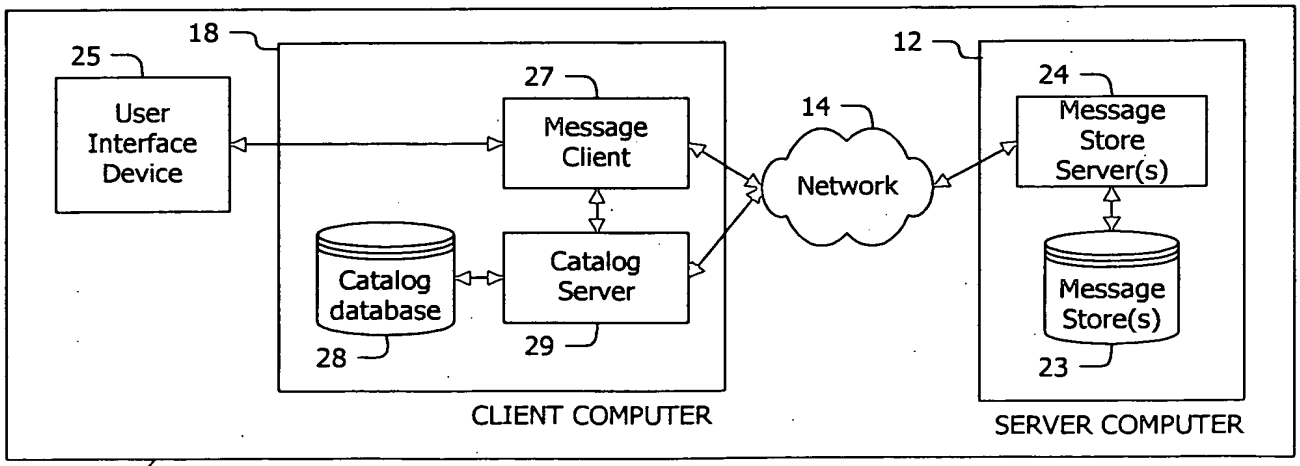


FIG. 4C

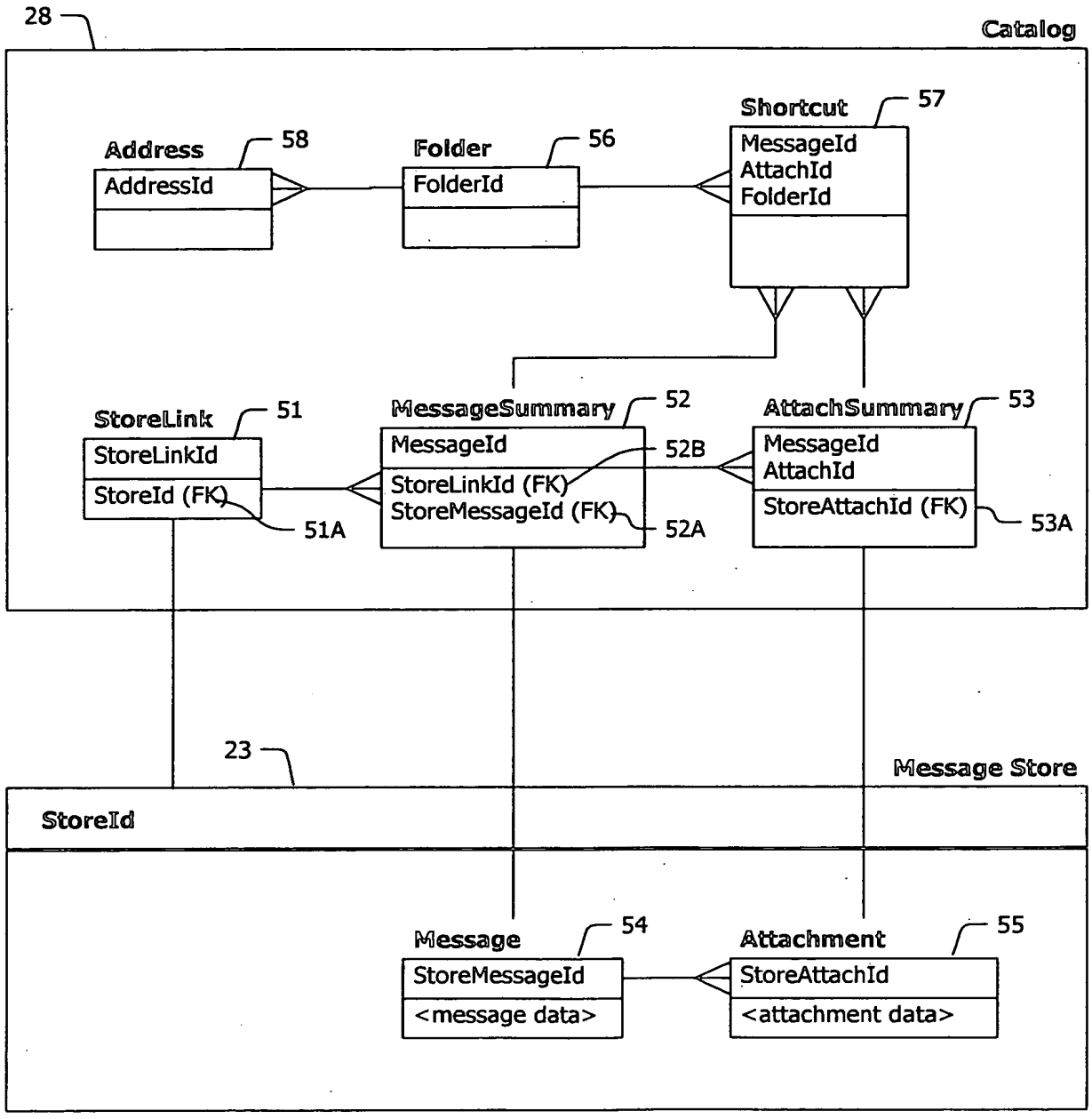

28
Catalog
Shortcut
57
Address
58
Folder
56
AddressId
FolderId
MessageId
AttachId
FolderId
StoreLink
51
MessageSummary
52
AttachSummary
53
StoreLinkId
StoreId (FK)
MessageId
StoreLinkId (FK)
StoreMessageId (FK)
52B
MessageId
AttachId
StoreAttachId (FK)
51A
52A
53A
23
Message Store
StoreId
Message
54
Attachment
55
StoreMessageId
<message data>
StoreAttachId
<attachment data>

FIG. 5A

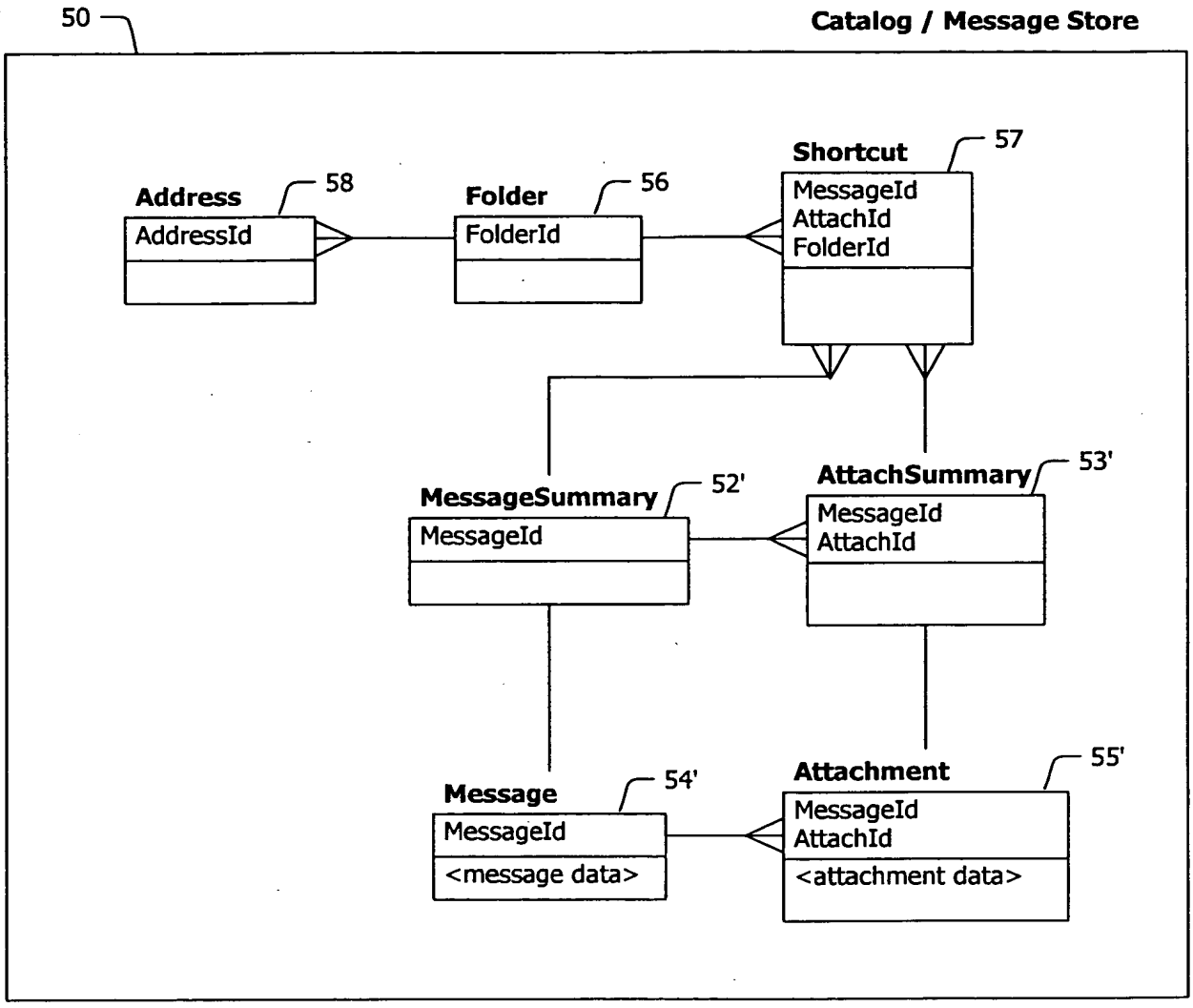

50
Catalog / Message Store
Address
58
AddressId
Folder
56
FolderId
Shortcut
57
MessageId
AttachId
FolderId
MessageSummary
52'
MessageId
AttachSummary
53'
MessageId
AttachId
Message
54'
MessageId
<message data>
Attachment
55'
MessageId
AttachId
<attachment data>

FIG. 5B

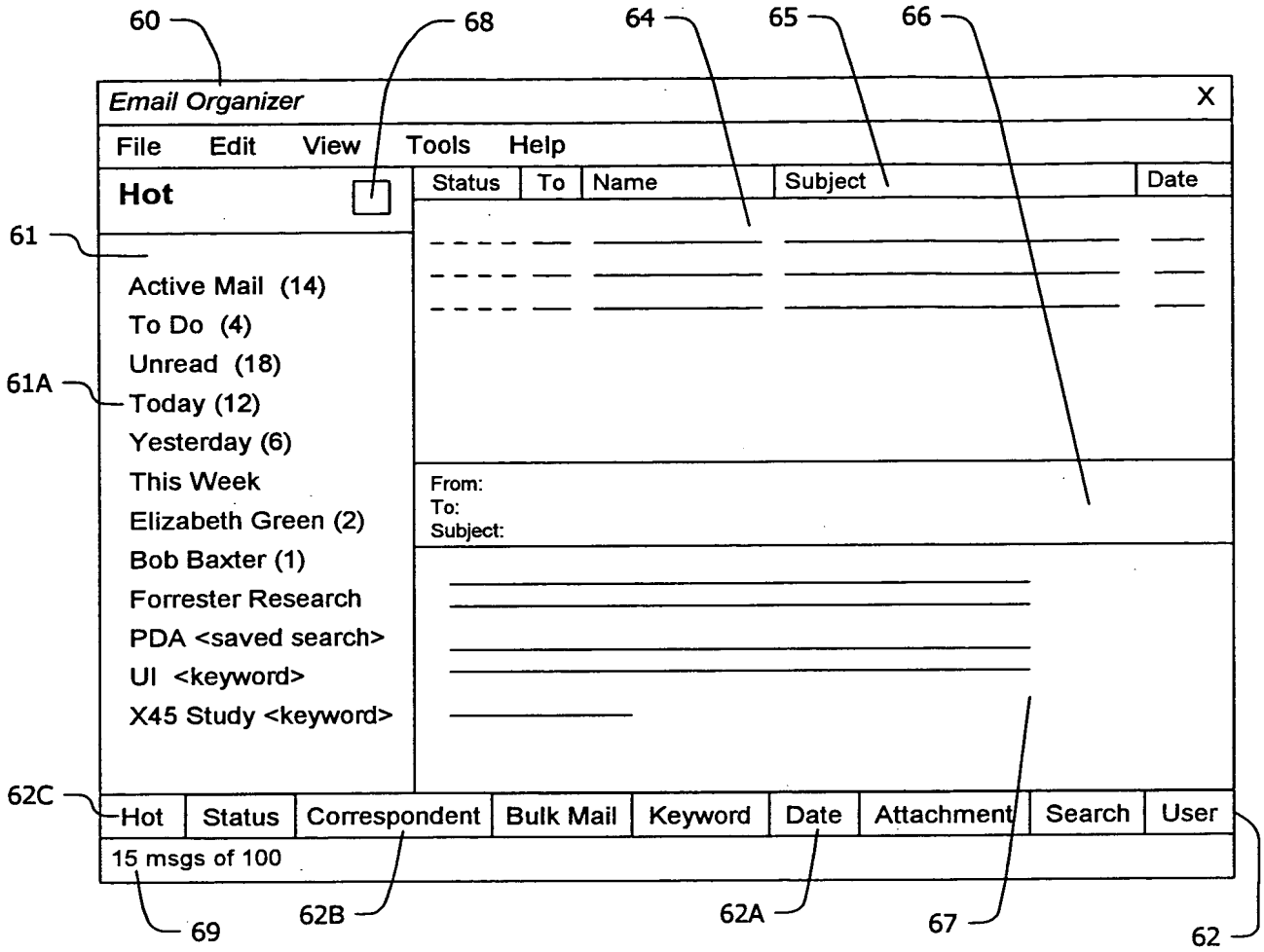

60
68
64
65
66
Email Organizer
X
File
Edit
View
Tools
Help
Hot
Status
To
Name
Subject
Date
61
Active Mail (14)
To Do (4)
Unread (18)
61A
Today (12)
Yesterday (6)
This Week
Elizabeth Green (2)
Bob Baxter (1)
Forrester Research
PDA <saved search>
UI <keyword>
X45 Study <keyword>
From:
To:
Subject:
62C
Hot
Status
Correspondent
Bulk Mail
Keyword
Date
Attachment
Search
User
15 msgs of 100
69
62B
62A
67
62

FIG. 6

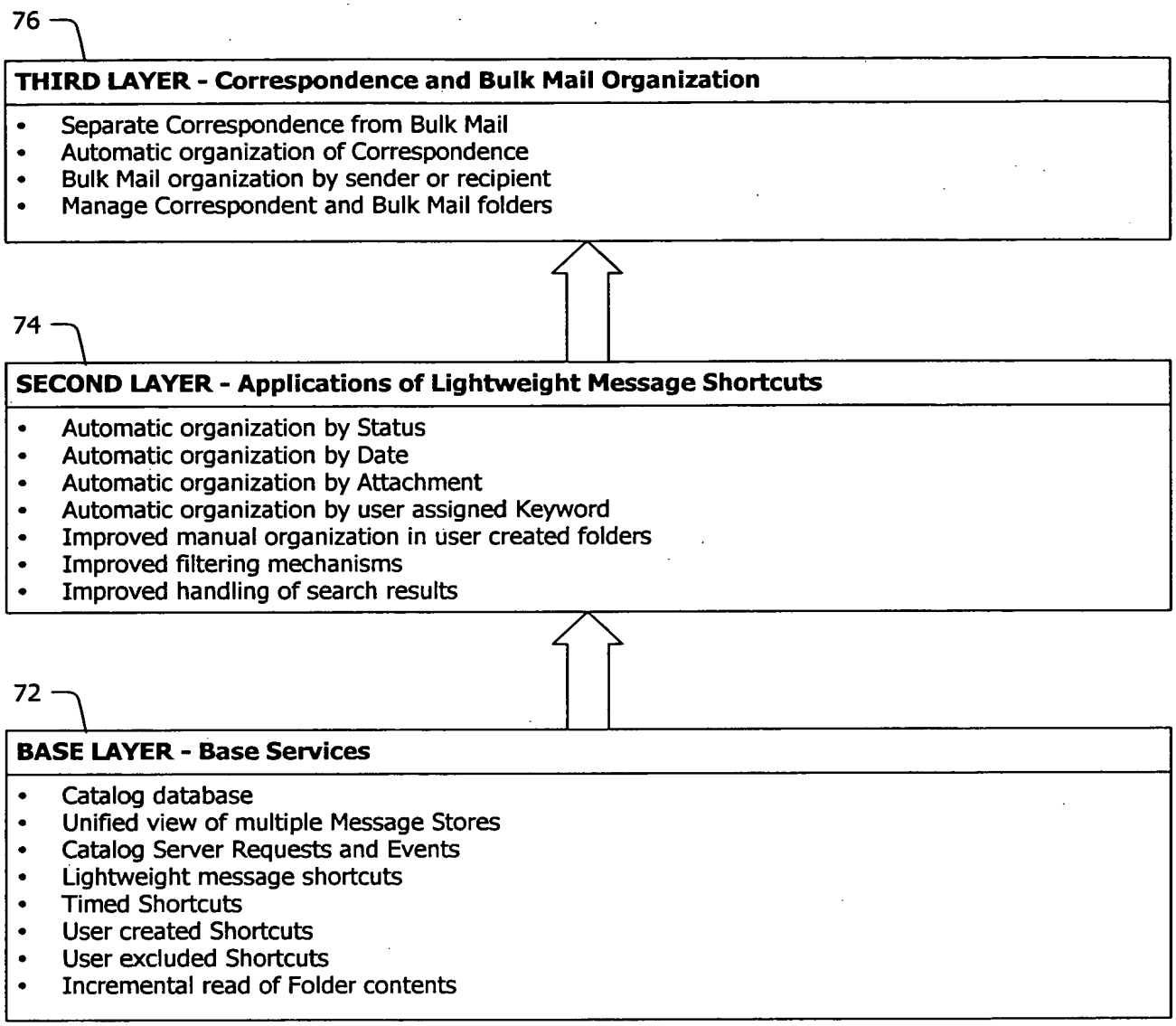

76
THIRD LAYER - Correspondence and Bulk Mail Organization
• Separate Correspondence from Bulk Mail
• Automatic organization of Correspondence
• Bulk Mail organization by sender or recipient
• Manage Correspondent and Bulk Mail folders
74
SECOND LAYER - Applications of Lightweight Message Shortcuts
• Automatic organization by Status
• Automatic organization by Date
• Automatic organization by Attachment
• Automatic organization by user assigned Keyword
• Improved manual organization in user created folders
• Improved filtering mechanisms
• Improved handling of search results
72
BASE LAYER - Base Services
• Catalog database
• Unified view of multiple Message Stores
• Catalog Server Requests and Events
• Lightweight message shortcuts
• Timed Shortcuts
• User created Shortcuts
• User excluded Shortcuts
• Incremental read of Folder contents

FIG. 7

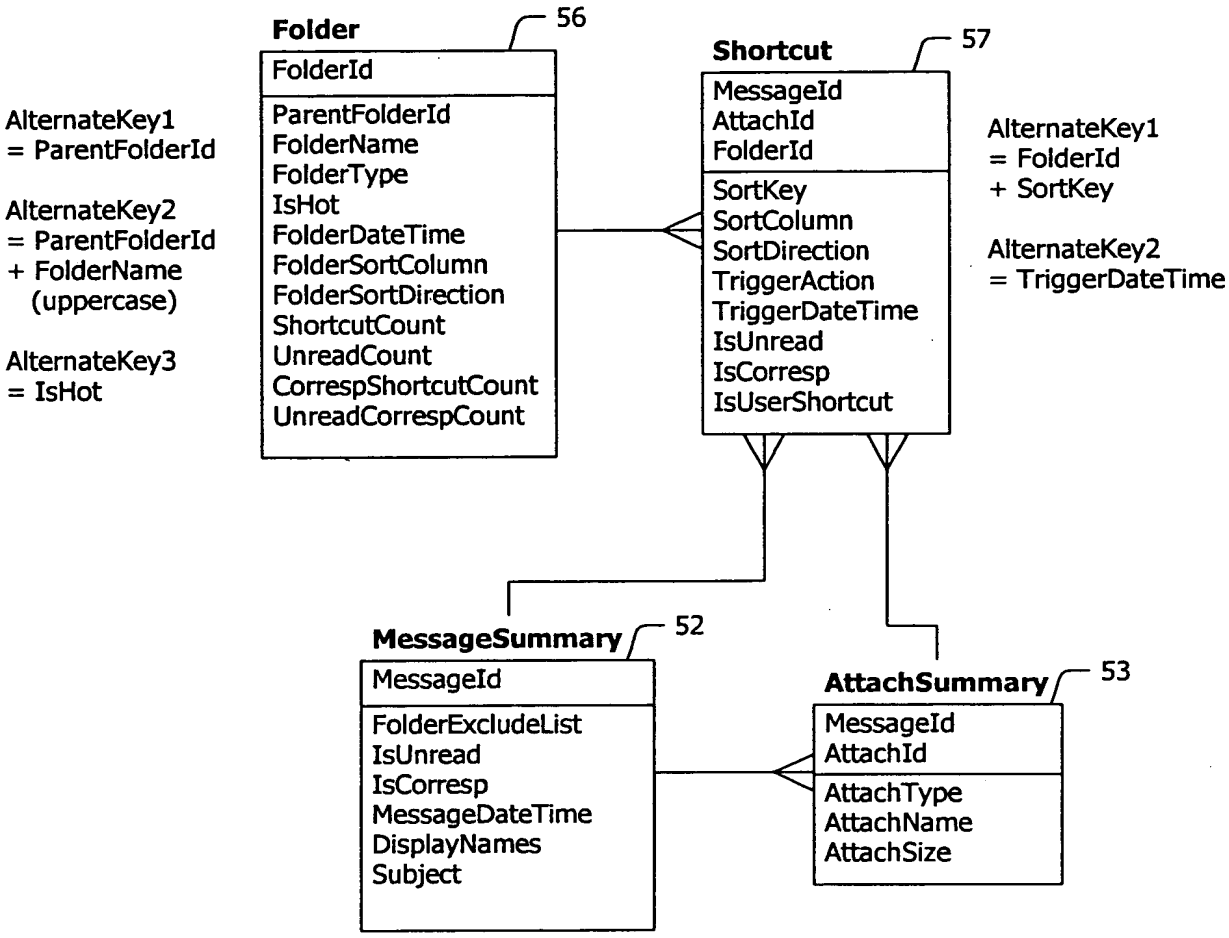

Folder
56
FolderId
ParentFolderId
FolderName
FolderType
IsHot
FolderDateTime
FolderSortColumn
FolderSortDirection
ShortcutCount
UnreadCount
CorrespShortcutCount
UnreadCorrespCount
AlternateKey1
= ParentFolderId
AlternateKey2
= ParentFolderId
+ FolderName
(uppercase)
AlternateKey3
= IsHot
Shortcut
57
MessageId
AttachId
FolderId
SortKey
SortColumn
SortDirection
TriggerAction
TriggerDateTime
IsUnread
IsCorresp
IsUserShortcut
AlternateKey1
= FolderId
+ SortKey
AlternateKey2
= TriggerDateTime
MessageSummary
52
MessageId
FolderExcludeList
IsUnread
IsCorresp
MessageDateTime
DisplayNames
Subject
AttachSummary
53
MessageId
AttachId
AttachType
AttachName
AttachSize

FIG. 8

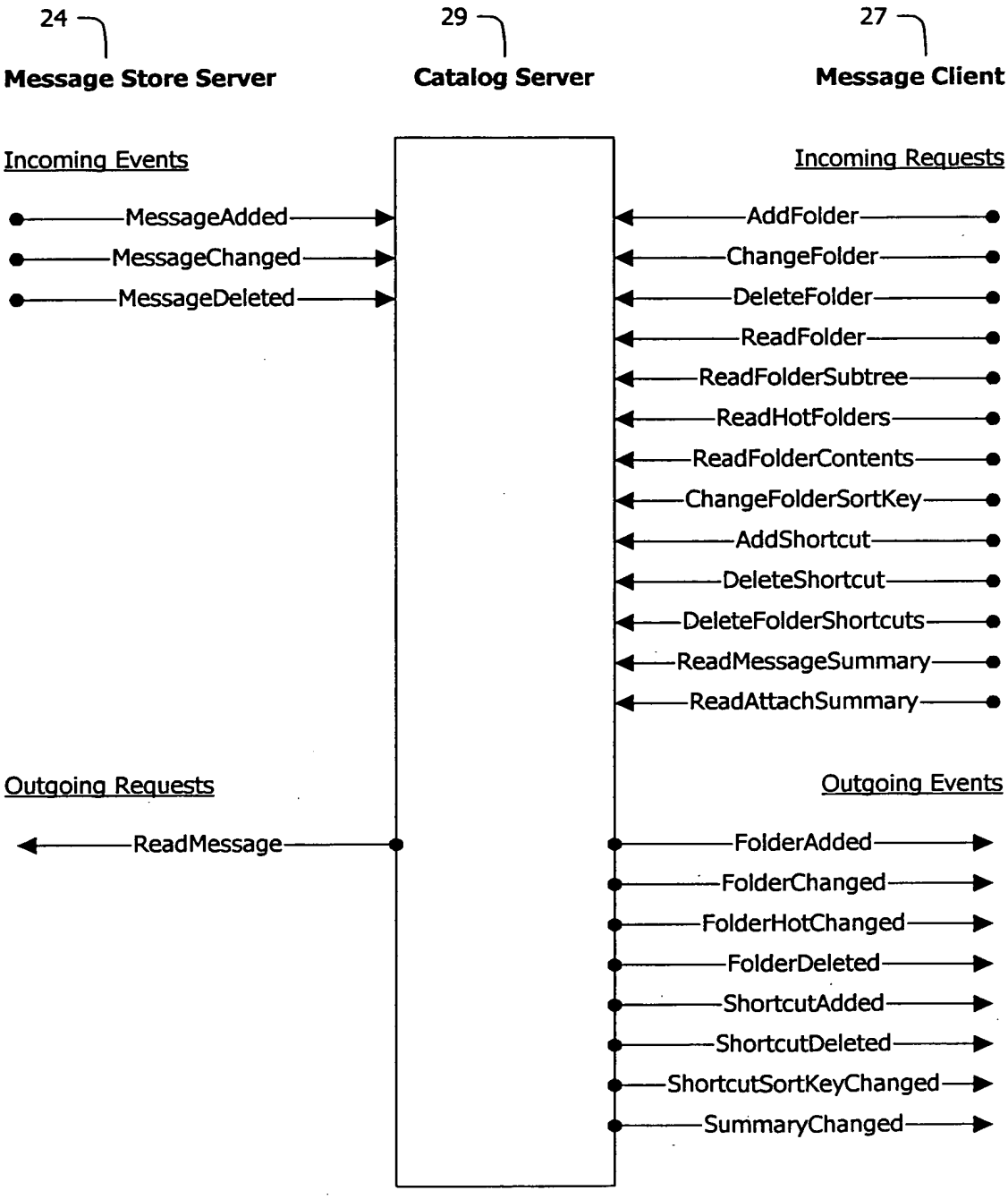

24
Message Store Server
29
Catalog Server
27
Message Client
Incoming Events
MessageAdded
MessageChanged
MessageDeleted
Incoming Requests
AddFolder
ChangeFolder
DeleteFolder
ReadFolder
ReadFolderSubtree
ReadHotFolders
ReadFolderContents
ChangeFolderSortKey
AddShortcut
DeleteShortcut
DeleteFolderShortcuts
ReadMessageSummary
ReadAttachSummary
Outgoing Requests
ReadMessage
Outgoing Events
FolderAdded
FolderChanged
FolderHotChanged
FolderDeleted
ShortcutAdded
ShortcutDeleted
ShortcutSortKeyChanged
SummaryChanged

FIG. 9

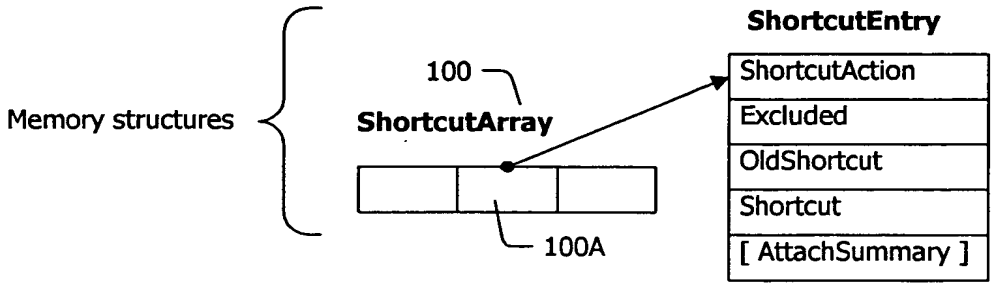


FIG. 10A

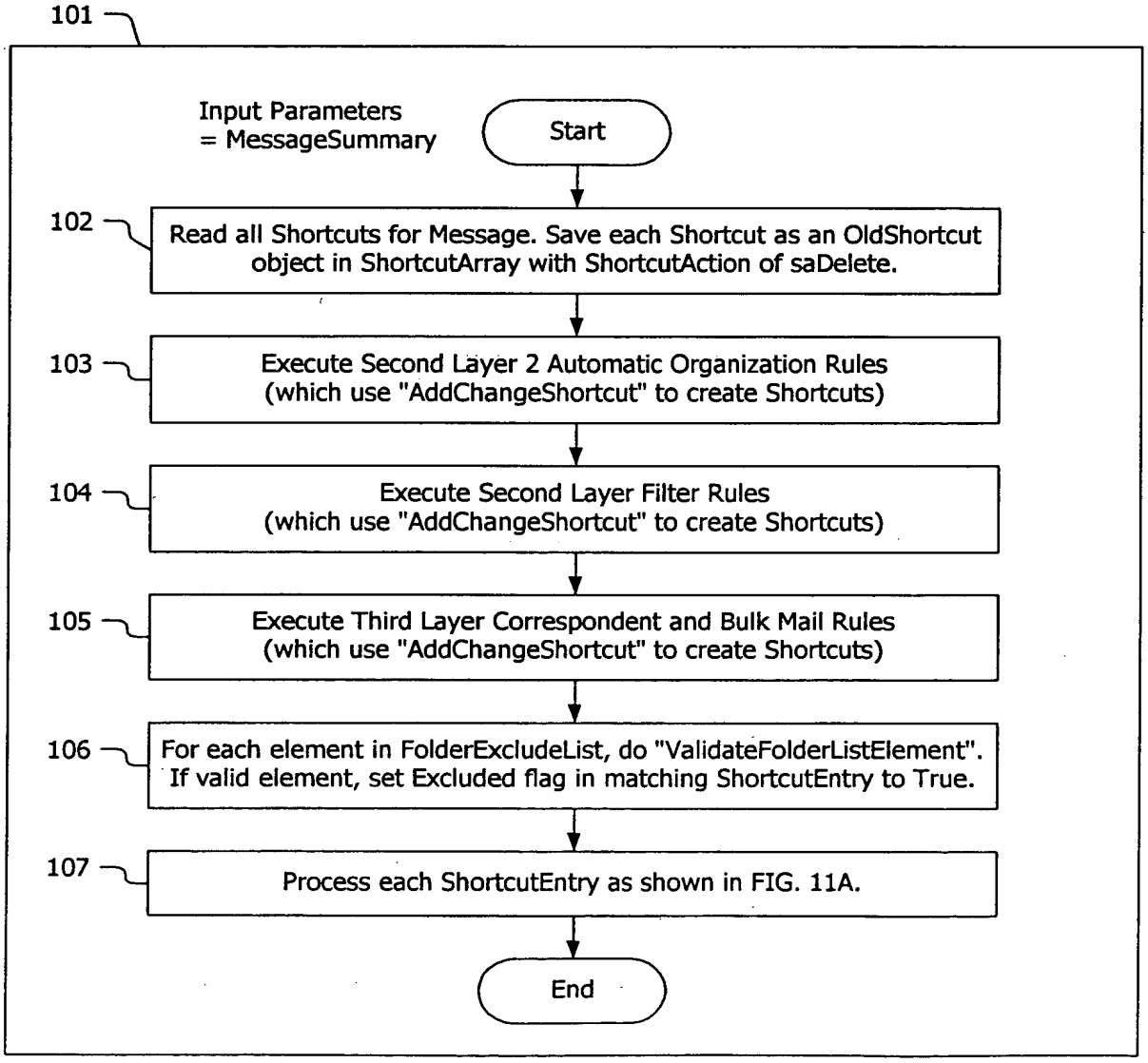


FIG. 10B

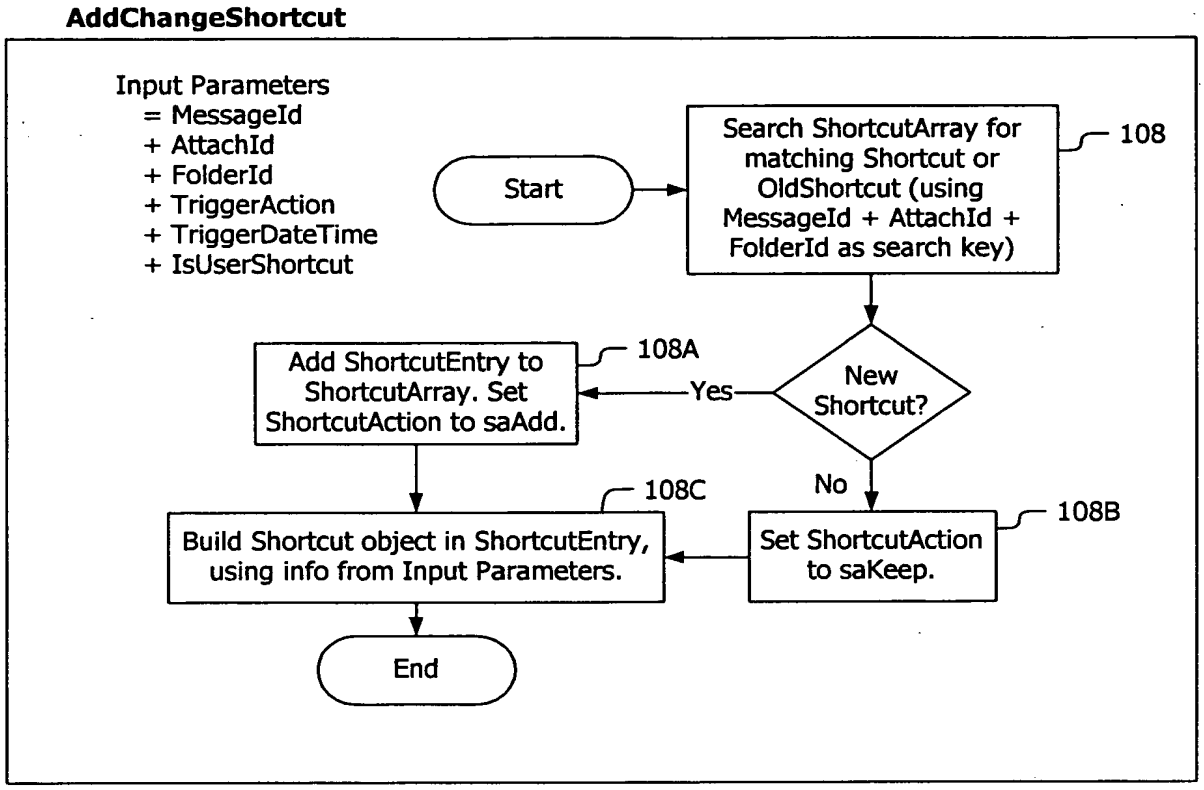


FIG. 10C

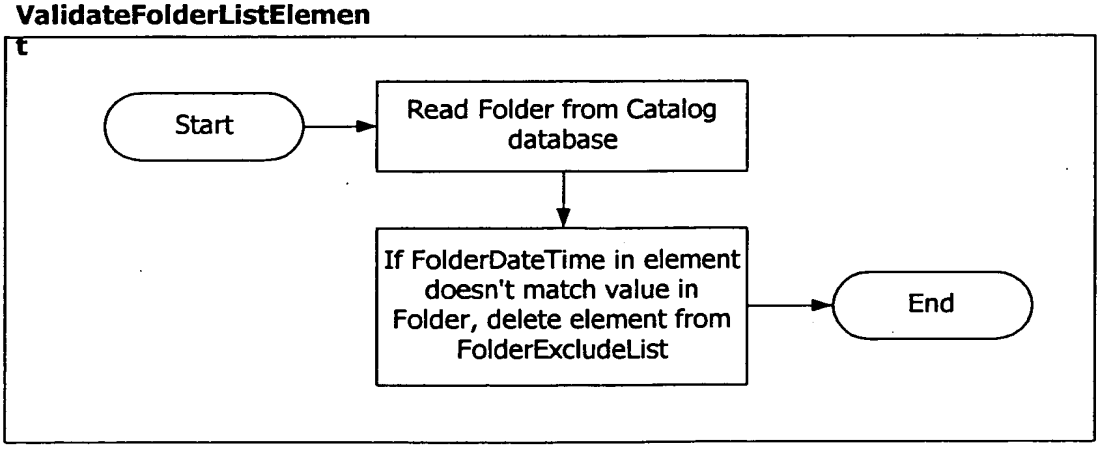


FIG. 10D

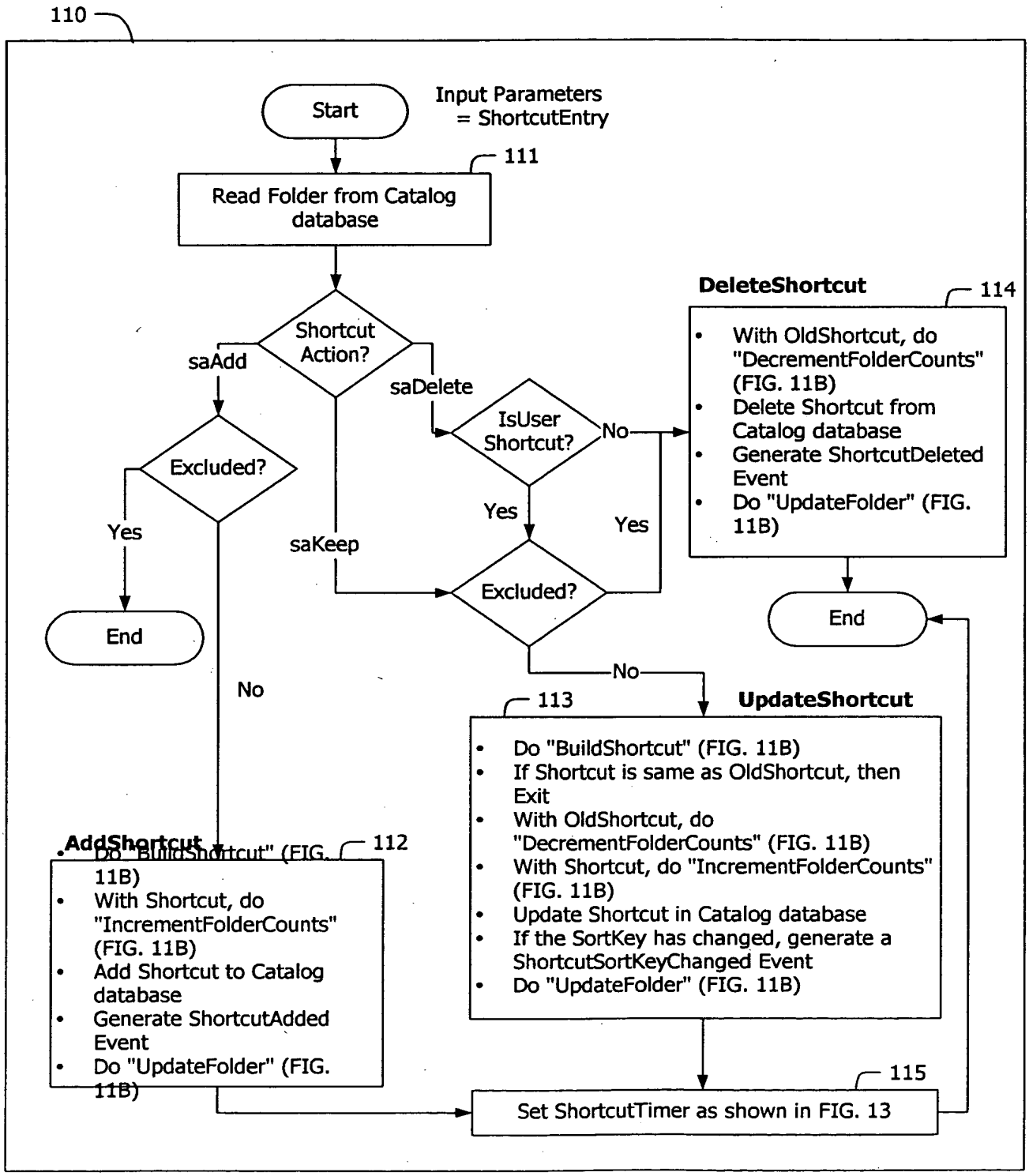

110
Start
Input Parameters
= ShortcutEntry
111
Read Folder from Catalog database
Shortcut Action?
saAdd
saDelete
saKeep
Excluded?
Yes
End
No
IsUser Shortcut?
No
Yes
Yes
Excluded?
No
DeleteShortcut
114
• With OldShortcut, do "DecrementFolderCounts" (FIG. 11B)
• Delete Shortcut from Catalog database
• Generate ShortcutDeleted Event
• Do "UpdateFolder" (FIG. 11B)
End
113
UpdateShortcut
• Do "BuildShortcut" (FIG. 11B)
• If Shortcut is same as OldShortcut, then Exit
• With OldShortcut, do "DecrementFolderCounts" (FIG. 11B)
• With Shortcut, do "IncrementFolderCounts" (FIG. 11B)
• Update Shortcut in Catalog database
• If the SortKey has changed, generate a ShortcutSortKeyChanged Event
• Do "UpdateFolder" (FIG. 11B)
AddShortcut
112
• Do "BuildShortcut" (FIG. 11B)
• With Shortcut, do "IncrementFolderCounts" (FIG. 11B)
• Add Shortcut to Catalog database
• Generate ShortcutAdded Event
• Do "UpdateFolder" (FIG. 11B)
115
Set ShortcutTimer as shown in FIG. 13

FIG. 11A

BuildShortcut

Finish building the Shortcut object in ShortcutEntry:
-- Build SortKey is shown in FIG. 12
-- Set SortKey and SortColumn (from Folder)
-- Set IsUnread and IsCorresp (from MessageSummary)

IncrementFolderCounts

- Increment ShortcutCount
- If Shortcut.IsUnread, increment UnreadCount
- If Shortcut.IsCorresp, increment CorrespShortcutCount
- If Shortcut.IsCorresp AND IsUnread, increment UnreadCorrespCount

DecrementFolderCounts

- Decrement ShortcutCount
- If Shortcut.IsUnread, decrement UnreadCount
- If Shortcut.IsCorresp, decrement CorrespShortcutCount
- If Shortcut.IsCorresp AND IsUnread, decrement UnreadCorrespCount

UpdateFolder

- Update Folder in Catalog database
- Generate FolderChanged Event

FIG. 11B

SHORTCUT STRUCTURE

Byte Offset	Length	Field
0	4	MessageId
4	2	AttachId
6	4	FolderId
10	6	SortKey
16	1	SortColumn
17	1	TriggerAction
18	4	TriggerDateTime
22	1	Flags
23	1	IsCorresp

FLAGS ENCODING

Bit	Length	Field
0	1	SortDirection
1	1	IsUnread
2	1	IsUserShortcut

FIELD TYPE	SORT KEY FORMAT	Notes
UnicodeString	UCW1 | UCW2 | UCW3	Unicode Character Weights of first 3 characters of string.
AnsiString	C1 | C2 | C3 | C4 | C5 | C6	Values of first 6 characters of string.
DateTime	YY | MM | DD | hh | mm | ss	YY = Year - 1950
Enumeration OR Boolean (sdDescending)	Value | YY | MM | DD | hh	YY = Year - 1950
Enumeration OR Boolean (sdAscending)	Value | 255 - YY | 255 - MM | 255 - DD | 255 - hh	YY = Year - 1950
Integer32 OR Integer16	---------- Bits ---------- 31-24 | 23-16 | 15-8 | 7-0 | Not Used	Bits are numbered with 0 being the least significant and 31 the most significant.

FIG. 12

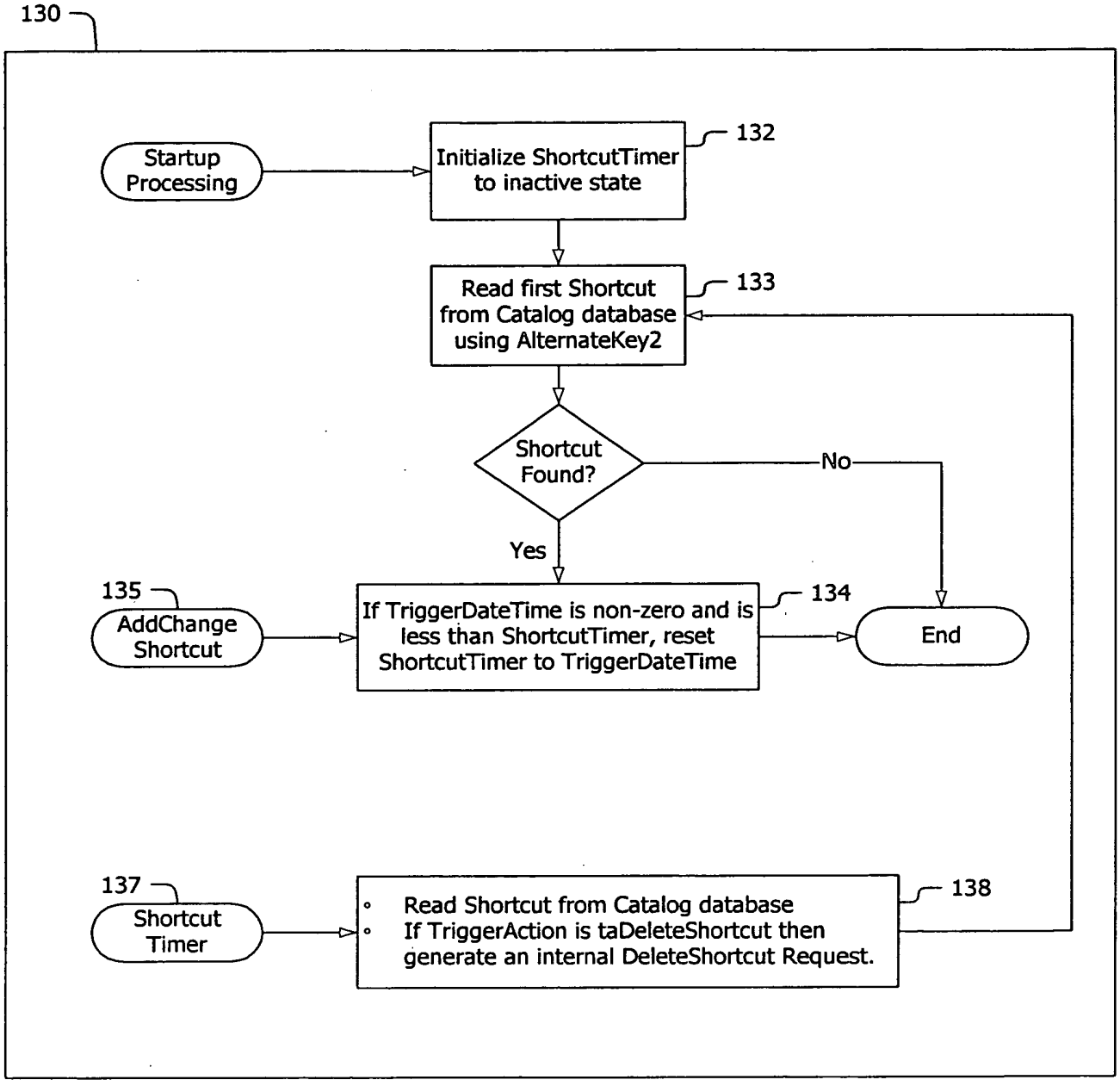

130
Startup Processing
Initialize ShortcutTimer to inactive state
132
Read first Shortcut from Catalog database using AlternateKey2
133
Shortcut Found?
No
Yes
135
AddChange Shortcut
If TriggerDateTime is non-zero and is less than ShortcutTimer, reset ShortcutTimer to TriggerDateTime
134
End
137
Shortcut Timer
Read Shortcut from Catalog database
If TriggerAction is taDeleteShortcut then generate an internal DeleteShortcut Request.
138

FIG. 13

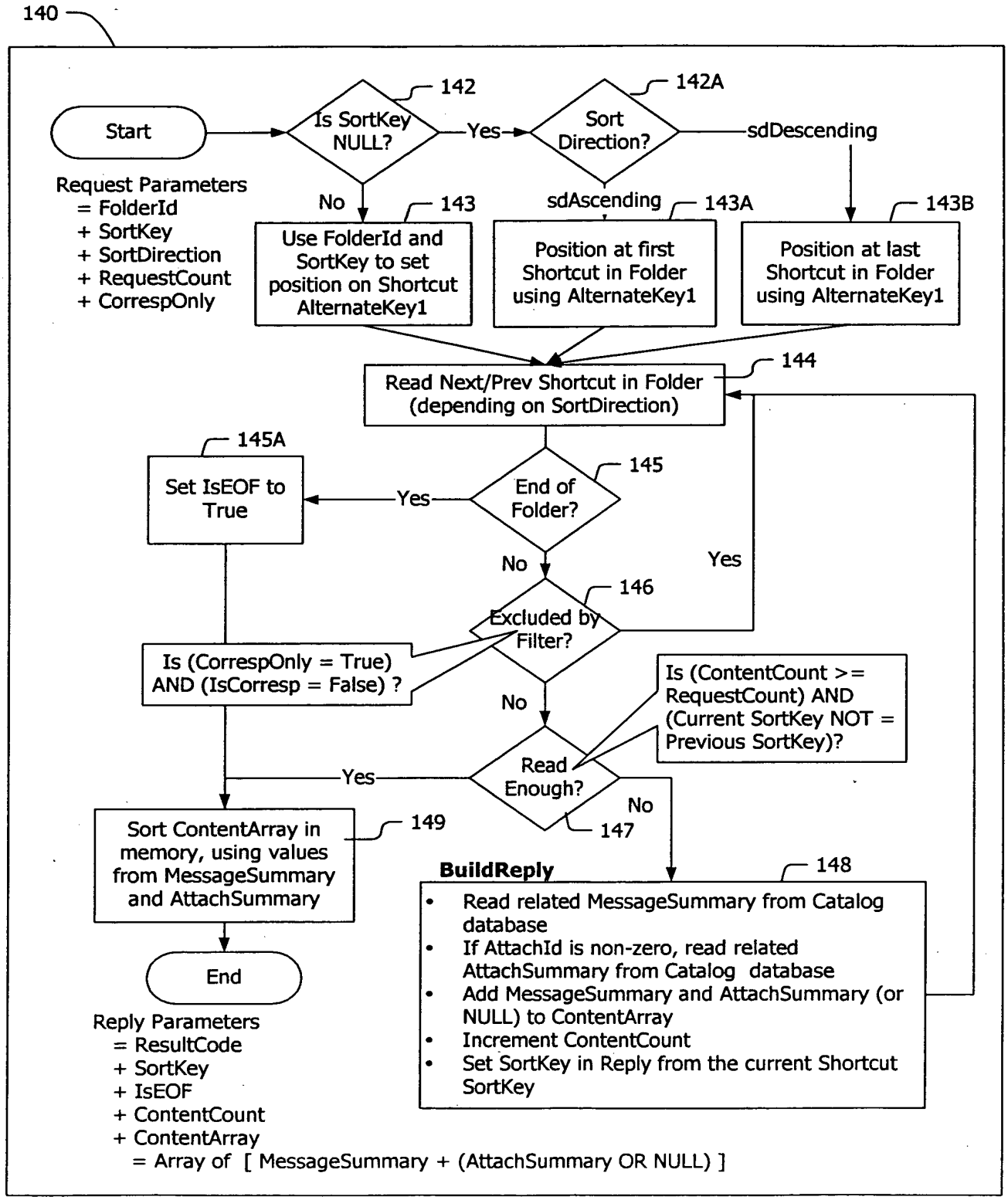

140
Start
142
Is SortKey NULL?
Yes
142A
Sort Direction?
sdDescending
Request Parameters
= FolderId
+ SortKey
+ SortDirection
+ RequestCount
+ CorrespOnly
No
143
Use FolderId and SortKey to set position on Shortcut AlternateKey1
sdAscending
143A
Position at first Shortcut in Folder using AlternateKey1
143B
Position at last Shortcut in Folder using AlternateKey1
144
Read Next/Prev Shortcut in Folder (depending on SortDirection)
145A
Set IsEOF to True
Yes
145
End of Folder?
No
Yes
146
Excluded by Filter?
Is (CorrespOnly = True) AND (IsCorresp = False) ?
No
Is (ContentCount >= RequestCount) AND (Current SortKey NOT = Previous SortKey)?
Yes
Read Enough?
No
147
149
Sort ContentArray in memory, using values from MessageSummary and AttachSummary
BuildReply
148
• Read related MessageSummary from Catalog database
• If AttachId is non-zero, read related AttachSummary from Catalog database
• Add MessageSummary and AttachSummary (or NULL) to ContentArray
• Increment ContentCount
• Set SortKey in Reply from the current Shortcut SortKey
End
Reply Parameters
= ResultCode
+ SortKey
+ IsEOF
+ ContentCount
+ ContentArray
= Array of [MessageSummary + (AttachSummary OR NULL)]

FIG. 14

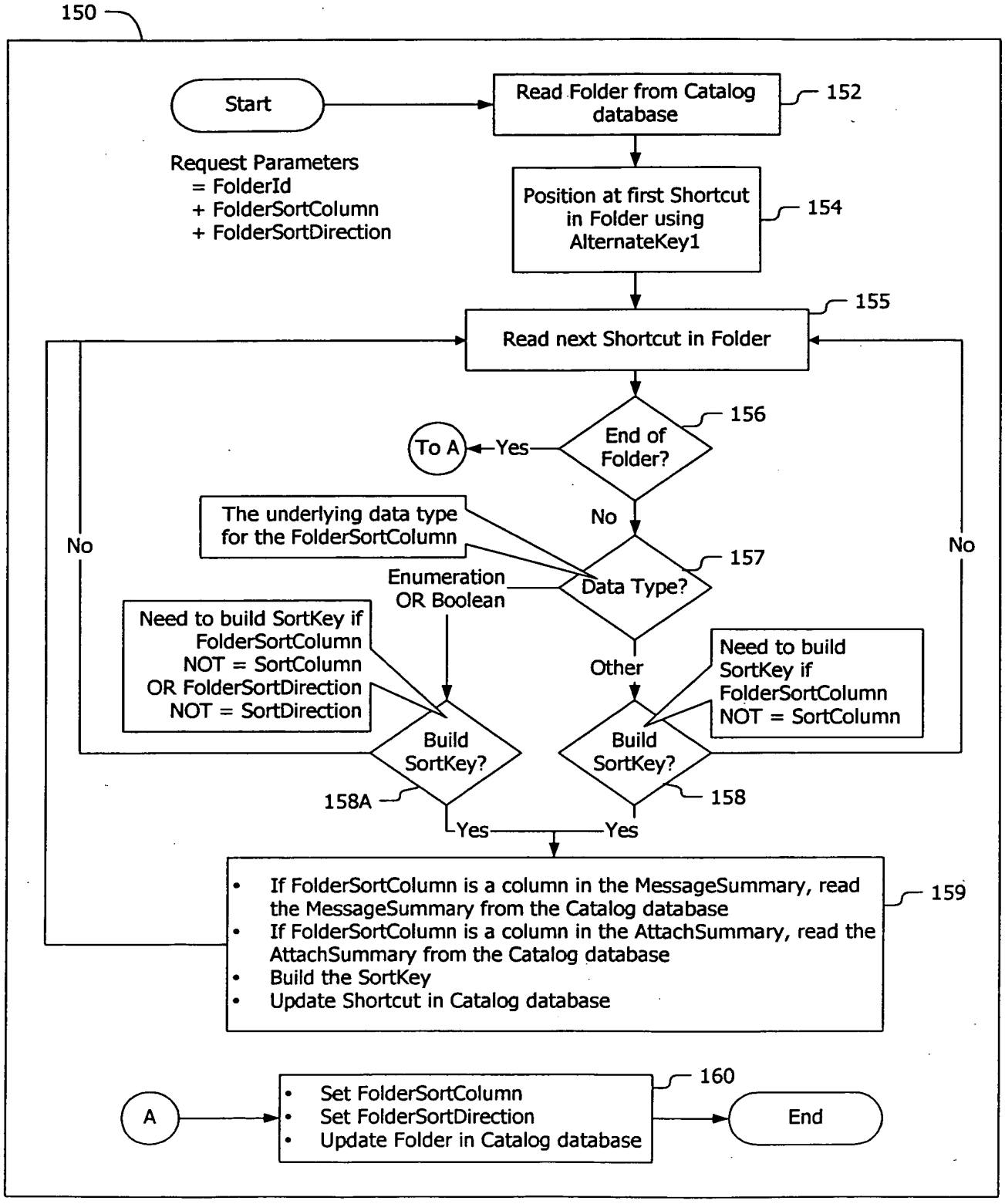

150
Start
Read Folder from Catalog database
152
Request Parameters
= FolderId
+ FolderSortColumn
+ FolderSortDirection
Position at first Shortcut in Folder using AlternateKey1
154
155
Read next Shortcut in Folder
156
End of Folder?
To A
Yes
No
The underlying data type for the FolderSortColumn
157
Data Type?
Enumeration OR Boolean
Other
No
No
Need to build SortKey if FolderSortColumn NOT = SortColumn OR FolderSortDirection NOT = SortDirection
Need to build SortKey if FolderSortColumn NOT = SortColumn
Build SortKey?
Build SortKey?
158A
158
Yes
Yes
159
If FolderSortColumn is a column in the MessageSummary, read the MessageSummary from the Catalog database
If FolderSortColumn is a column in the AttachSummary, read the AttachSummary from the Catalog database
Build the SortKey
Update Shortcut in Catalog database
160
A
Set FolderSortColumn
Set FolderSortDirection
Update Folder in Catalog database
End

FIG. 15

Contains all tables and fields of Base Layer, plus the following:

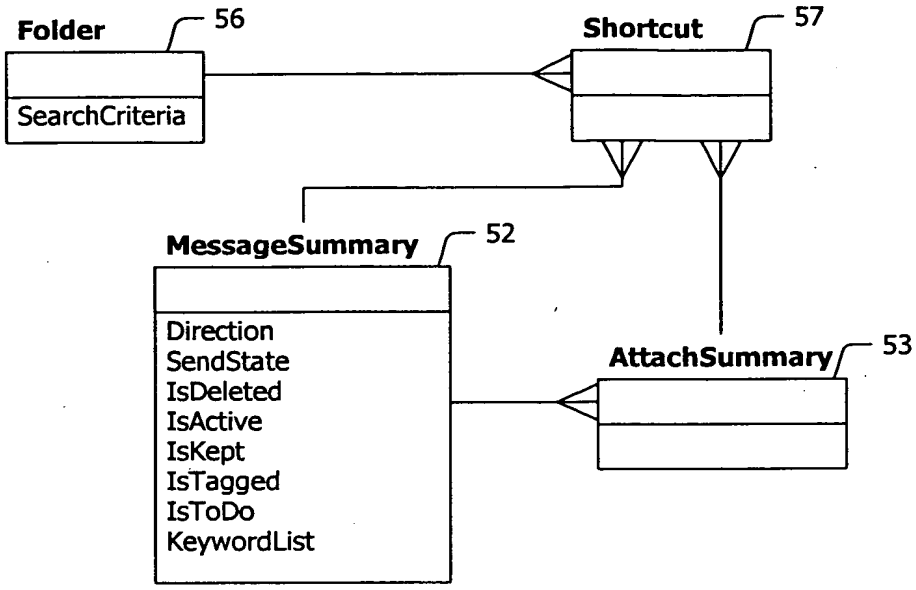


FIG. 16

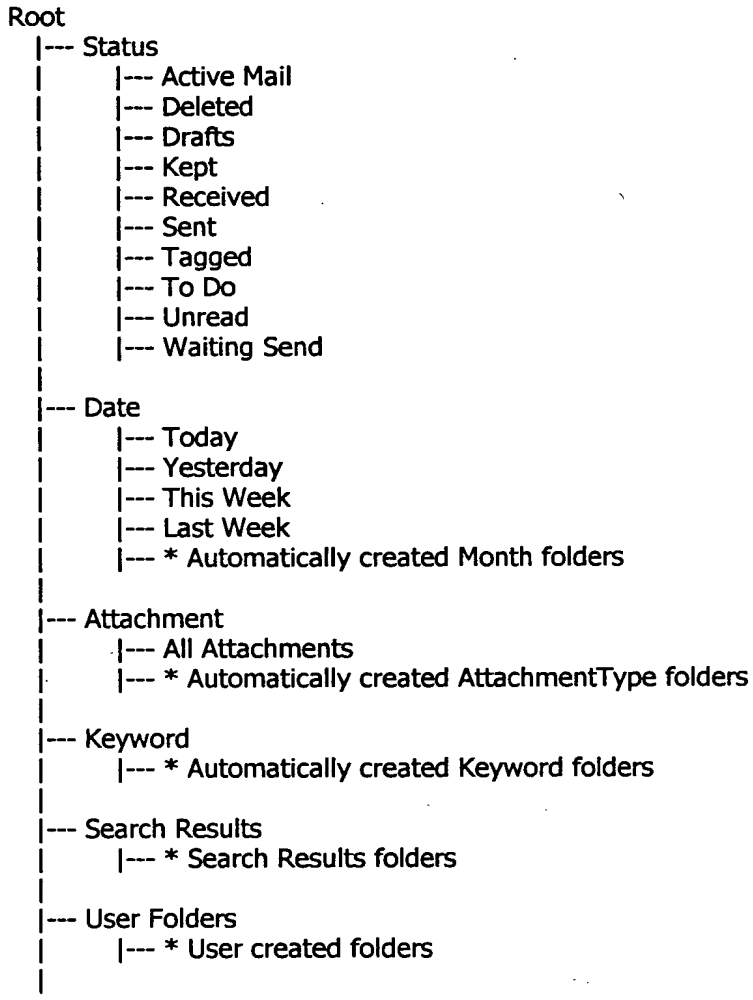
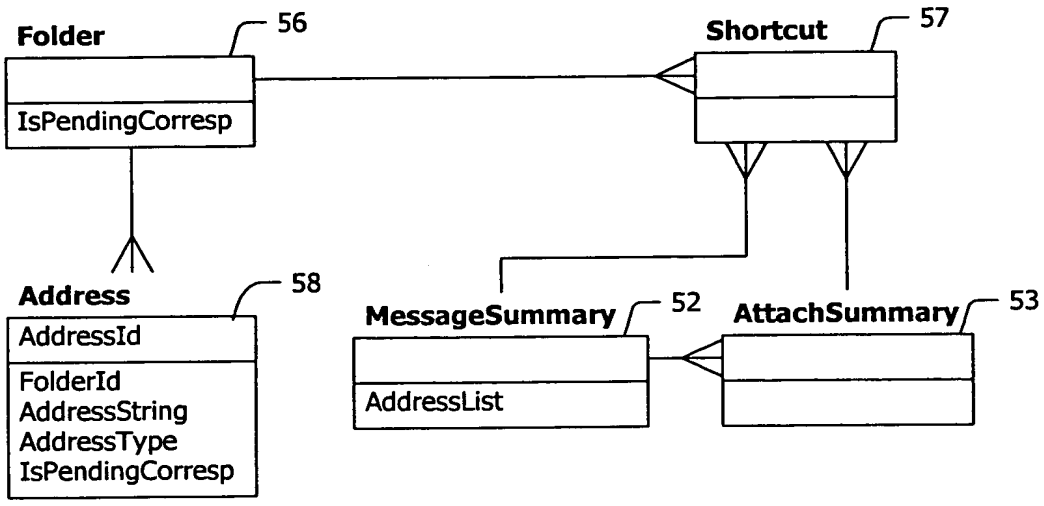

Root
|--- Status
|--- Active Mail
|--- Deleted
|--- Drafts
|--- Kept
|--- Received
|--- Sent
|--- Tagged
|--- To Do
|--- Unread
|--- Waiting Send
|--- Date
|--- Today
|--- Yesterday
|--- This Week
|--- Last Week
|--- * Automatically created Month folders
|--- Attachment
|--- All Attachments
|--- * Automatically created AttachmentType folders
|--- Keyword
|--- * Automatically created Keyword folders
|--- Search Results
|--- * Search Results folders
|--- User Folders
|--- * User created folders

FIG. 17

Contains all tables and fields of Base Layer and Second Layer, plus the following:



AlternateKey1
= AddressString
(uppercase)

AlternateKey2
= FolderId

FIG. 18

Contains all Folders in Base Layer and Second Layer, plus the following:

<Root>
|--- Correspondents
| |--- Me
| |--- * Automatically created Correspondent folders
| |--- * User created Correspondent folders
|
|--- Bulk Mail
| |--- Unsorted
| |--- * User created Bulk Mail folders

FIG. 19

Includes all Requests and Events in Base Layer and Second Layer, plus the following:

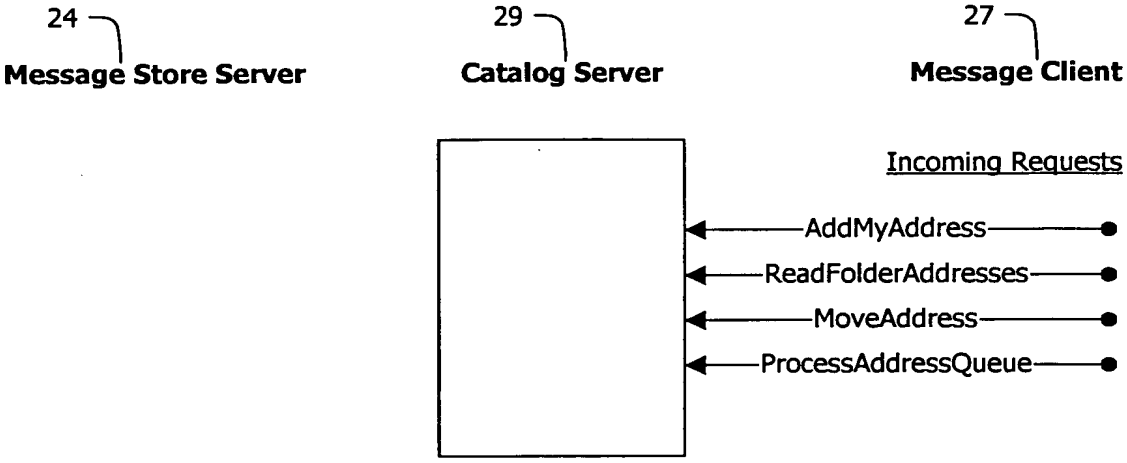


FIG. 20

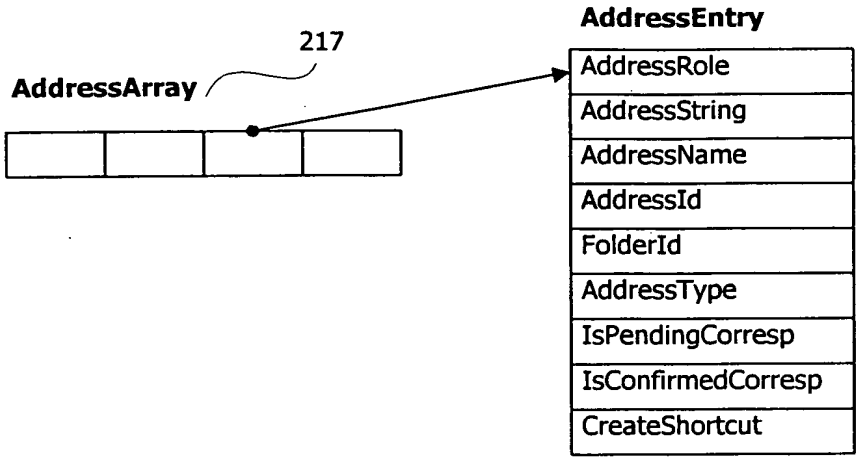


FIG. 21A

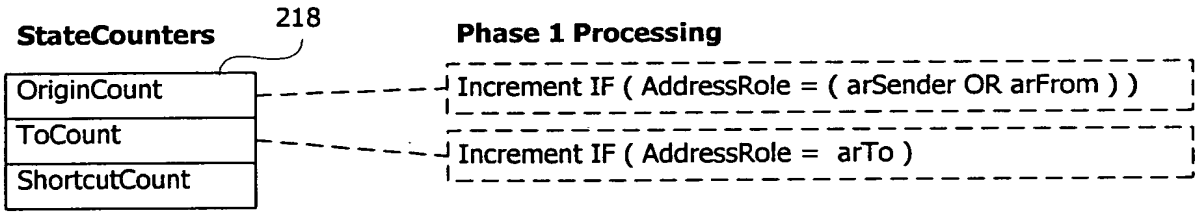


FIG. 21B

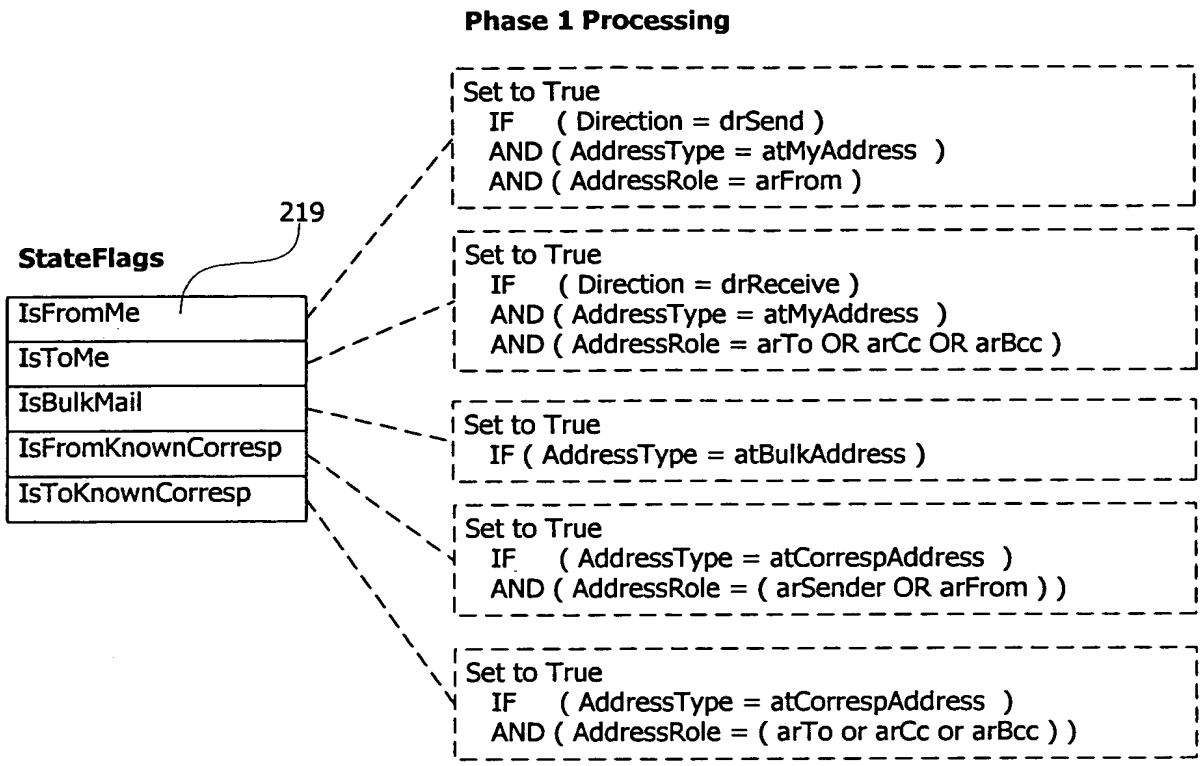

Phase 1 Processing
219
StateFlags
IsFromMe
IsToMe
IsBulkMail
IsFromKnownCorresp
IsToKnownCorresp
Set to True
IF (Direction = drSend)
AND (AddressType = atMyAddress)
AND (AddressRole = arFrom)
Set to True
IF (Direction = drReceive)
AND (AddressType = atMyAddress)
AND (AddressRole = arTo OR arCc OR arBcc)
Set to True
IF (AddressType = atBulkAddress)
Set to True
IF (AddressType = atCorrespAddress)
AND (AddressRole = (arSender OR arFrom))
Set to True
IF (AddressType = atCorrespAddress)
AND (AddressRole = (arTo or arCc or arBcc))

FIG. 21C

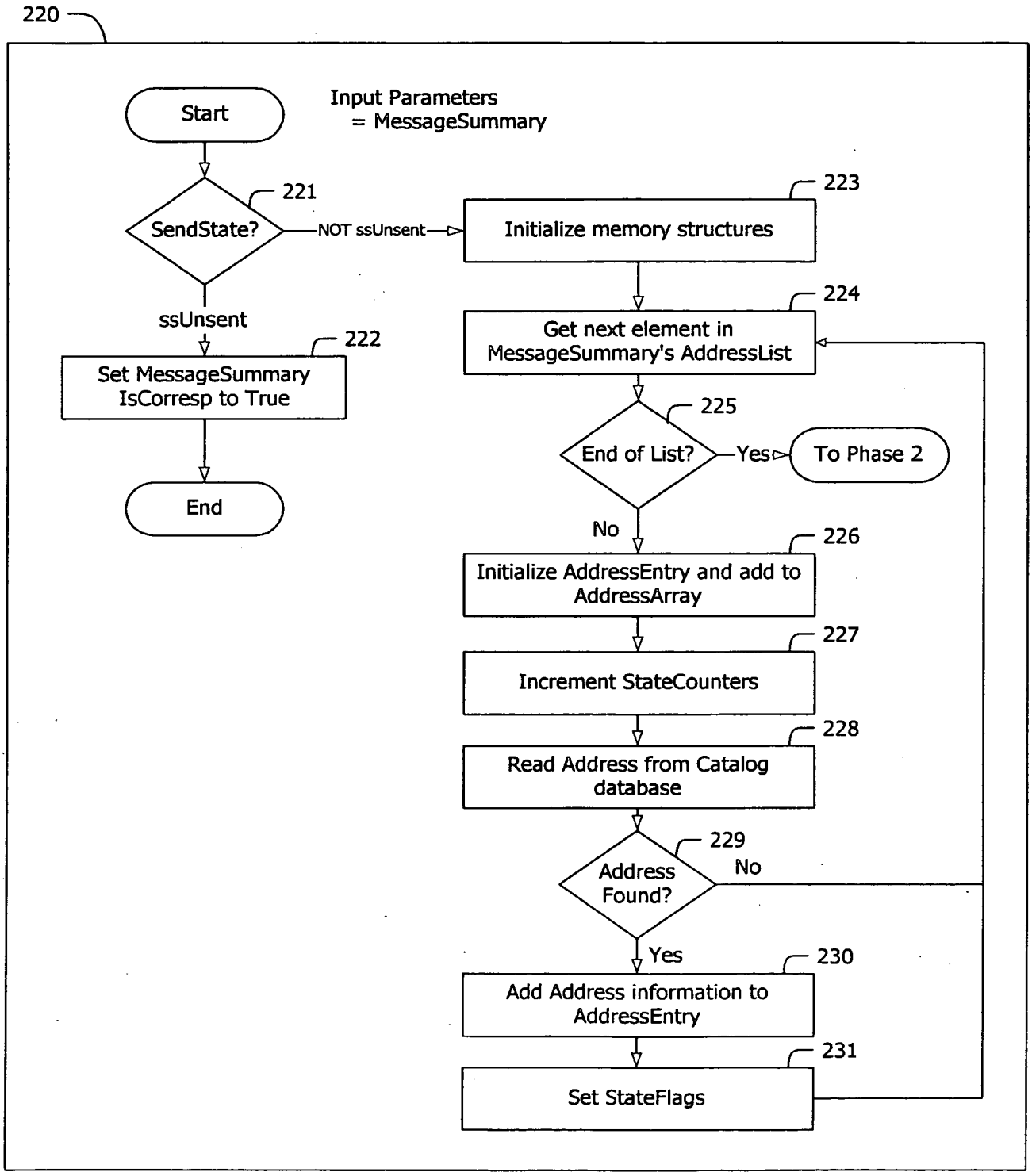

220
Start
Input Parameters
= MessageSummary
221
SendState?
NOT ssUnsent
223
Initialize memory structures
ssUnsent
222
Set MessageSummary
IsCorresp to True
End
224
Get next element in
MessageSummary's AddressList
225
End of List?
Yes
To Phase 2
No
226
Initialize AddressEntry and add to
AddressArray
227
Increment StateCounters
228
Read Address from Catalog
database
229
Address
Found?
No
Yes
230
Add Address information to
AddressEntry
231
Set StateFlags

FIG. 22

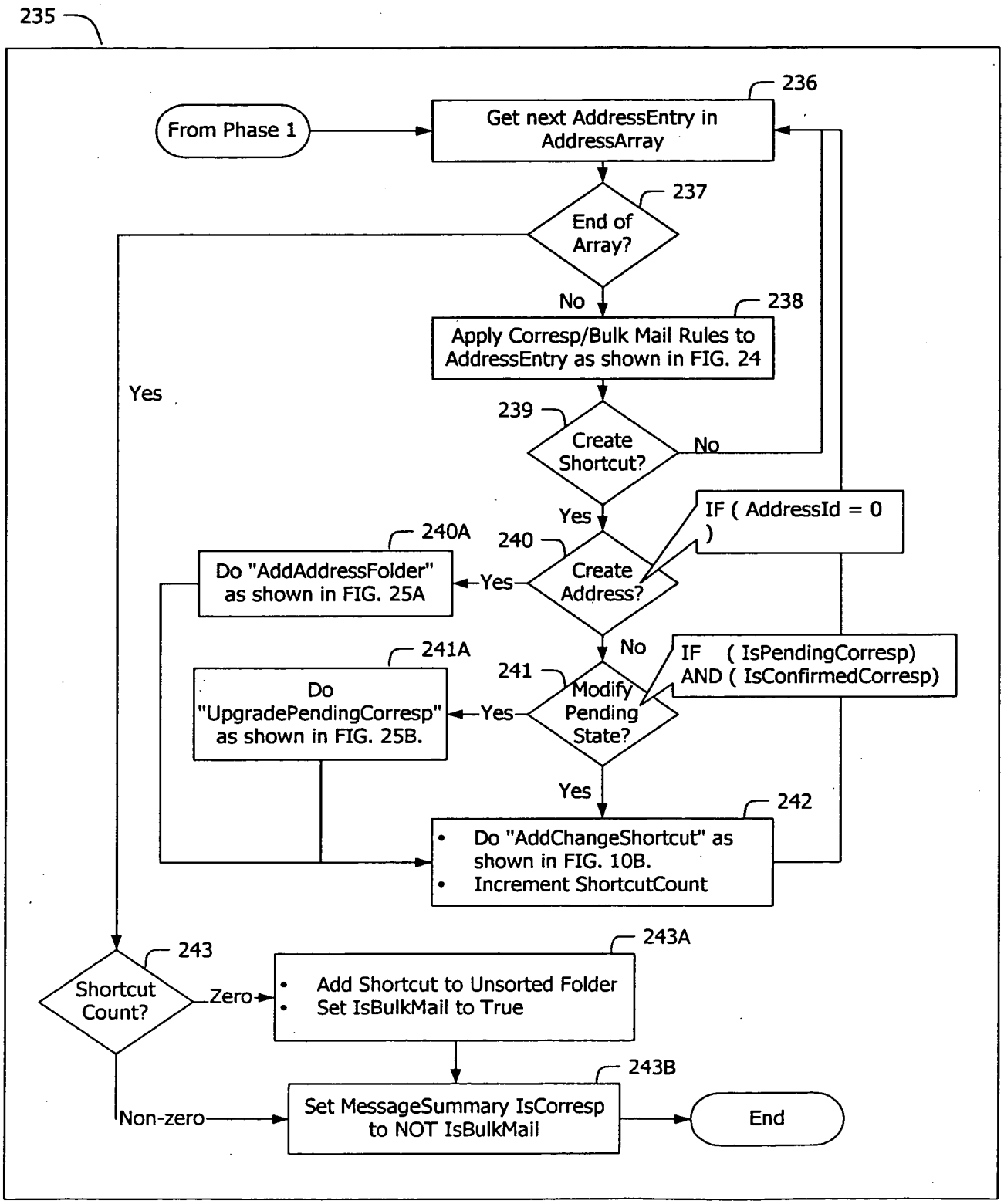

235
From Phase 1
236
Get next AddressEntry in AddressArray
237
End of Array?
No
238
Apply Corresp/Bulk Mail Rules to AddressEntry as shown in FIG. 24
Yes
239
Create Shortcut?
No
Yes
IF (AddressId = 0)
240A
240
Do "AddAddressFolder" as shown in FIG. 25A
Yes
Create Address?
No
241A
241
IF (IsPendingCorresp) AND (IsConfirmedCorresp)
Do "UpgradePendingCorresp" as shown in FIG. 25B.
Yes
Modify Pending State?
Yes
242
• Do "AddChangeShortcut" as shown in FIG. 10B.
• Increment ShortcutCount
243
243A
Shortcut Count?
Zero
• Add Shortcut to Unsorted Folder
• Set IsBulkMail to True
243B
Non-zero
Set MessageSummary IsCorresp to NOT IsBulkMail
End

FIG. 23

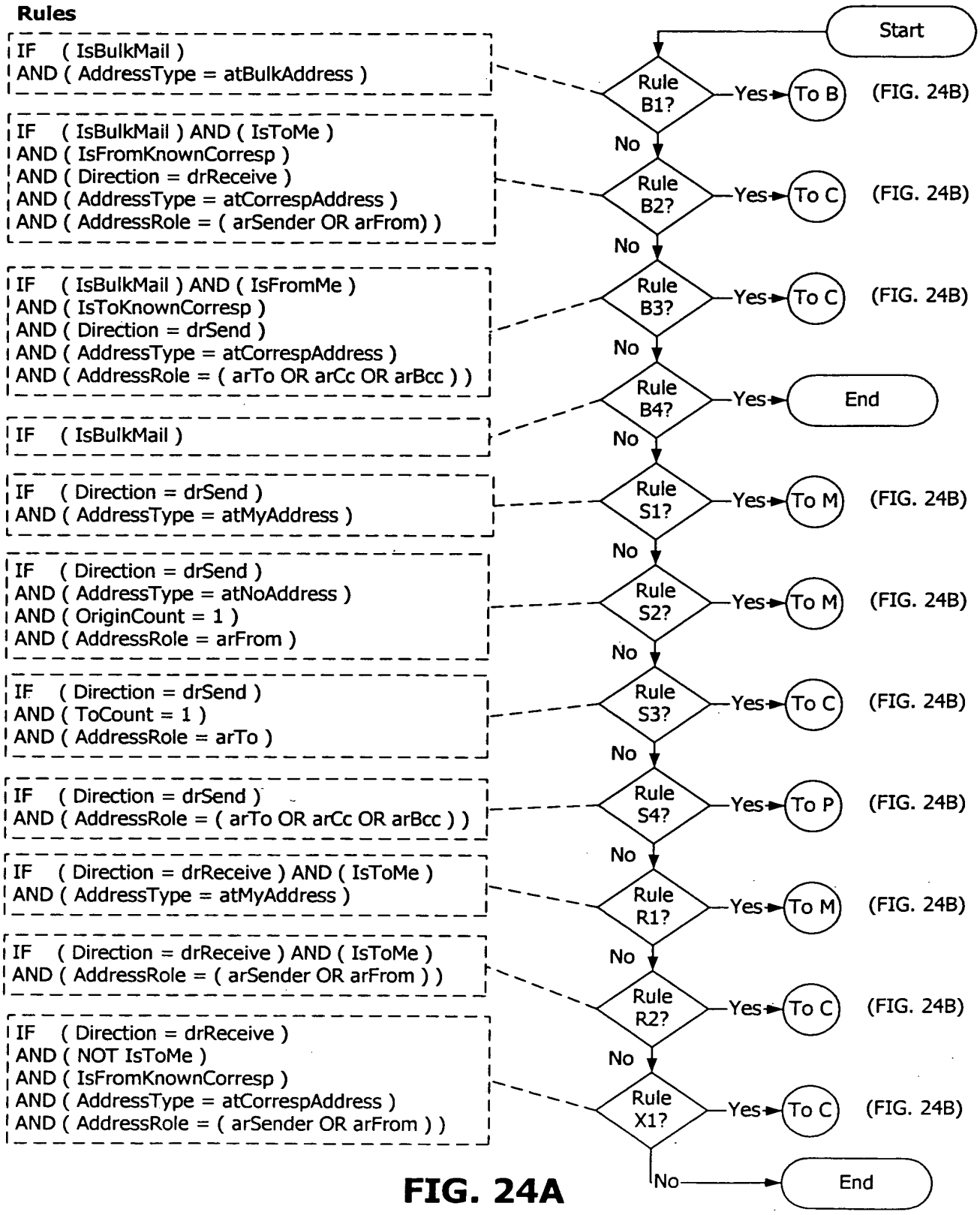

Rules
IF (IsBulkMail)
AND (AddressType = atBulkAddress)
IF (IsBulkMail) AND (IsToMe)
AND (IsFromKnownCorresp)
AND (Direction = drReceive)
AND (AddressType = atCorrespAddress)
AND (AddressRole = (arSender OR arFrom))
IF (IsBulkMail) AND (IsFromMe)
AND (IsToKnownCorresp)
AND (Direction = drSend)
AND (AddressType = atCorrespAddress)
AND (AddressRole = (arTo OR arCc OR arBcc))
IF (IsBulkMail)
IF (Direction = drSend)
AND (AddressType = atMyAddress)
IF (Direction = drSend)
AND (AddressType = atNoAddress)
AND (OriginCount = 1)
AND (AddressRole = arFrom)
IF (Direction = drSend)
AND (ToCount = 1)
AND (AddressRole = arTo)
IF (Direction = drSend)
AND (AddressRole = (arTo OR arCc OR arBcc))
IF (Direction = drReceive) AND (IsToMe)
AND (AddressType = atMyAddress)
IF (Direction = drReceive) AND (IsToMe)
AND (AddressRole = (arSender OR arFrom))
IF (Direction = drReceive)
AND (NOT IsToMe)
AND (IsFromKnownCorresp)
AND (AddressType = atCorrespAddress)
AND (AddressRole = (arSender OR arFrom))
Start
Rule B1?
Yes
To B
(FIG. 24B)
No
Rule B2?
Yes
To C
(FIG. 24B)
No
Rule B3?
Yes
To C
(FIG. 24B)
No
Rule B4?
Yes
End
No
Rule S1?
Yes
To M
(FIG. 24B)
No
Rule S2?
Yes
To M
(FIG. 24B)
No
Rule S3?
Yes
To C
(FIG. 24B)
No
Rule S4?
Yes
To P
(FIG. 24B)
No
Rule R1?
Yes
To M
(FIG. 24B)
No
Rule R2?
Yes
To C
(FIG. 24B)
No
Rule X1?
Yes
To C
(FIG. 24B)
No
End

FIG. 24A

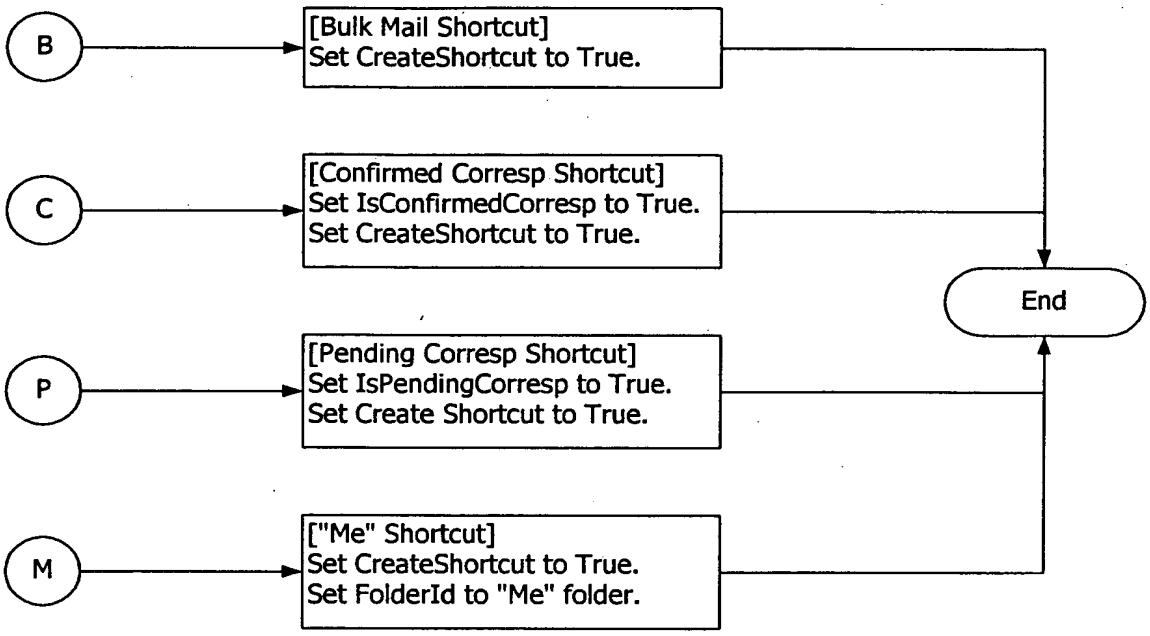

B
[Bulk Mail Shortcut]
Set CreateShortcut to True.
C
[Confirmed Corresp Shortcut]
Set IsConfirmedCorresp to True.
Set CreateShortcut to True.
End
P
[Pending Corresp Shortcut]
Set IsPendingCorresp to True.
Set Create Shortcut to True.
M
["Me" Shortcut]
Set CreateShortcut to True.
Set FolderId to "Me" folder.

FIG. 24B

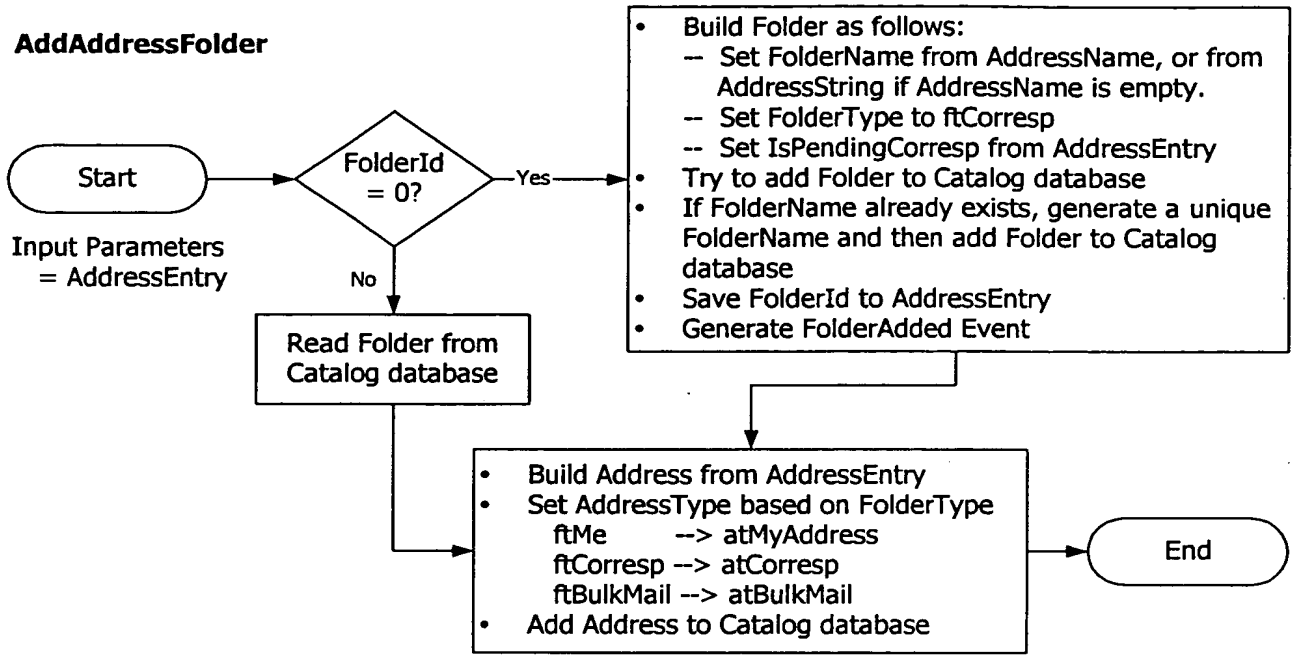


FIG. 25A

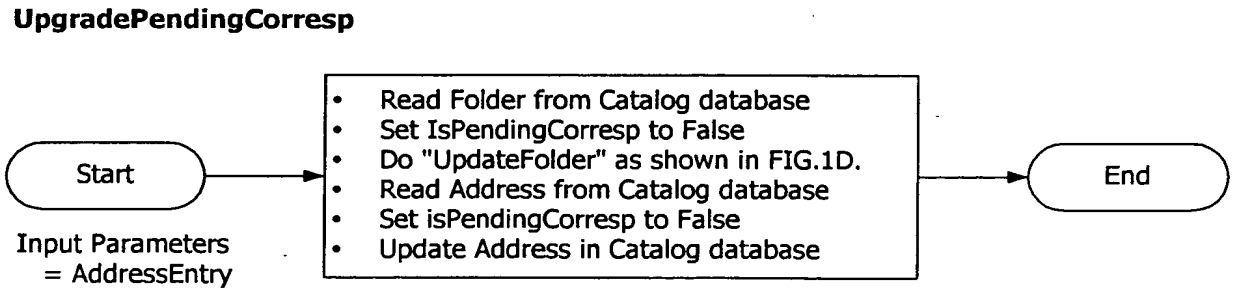


FIG. 25B

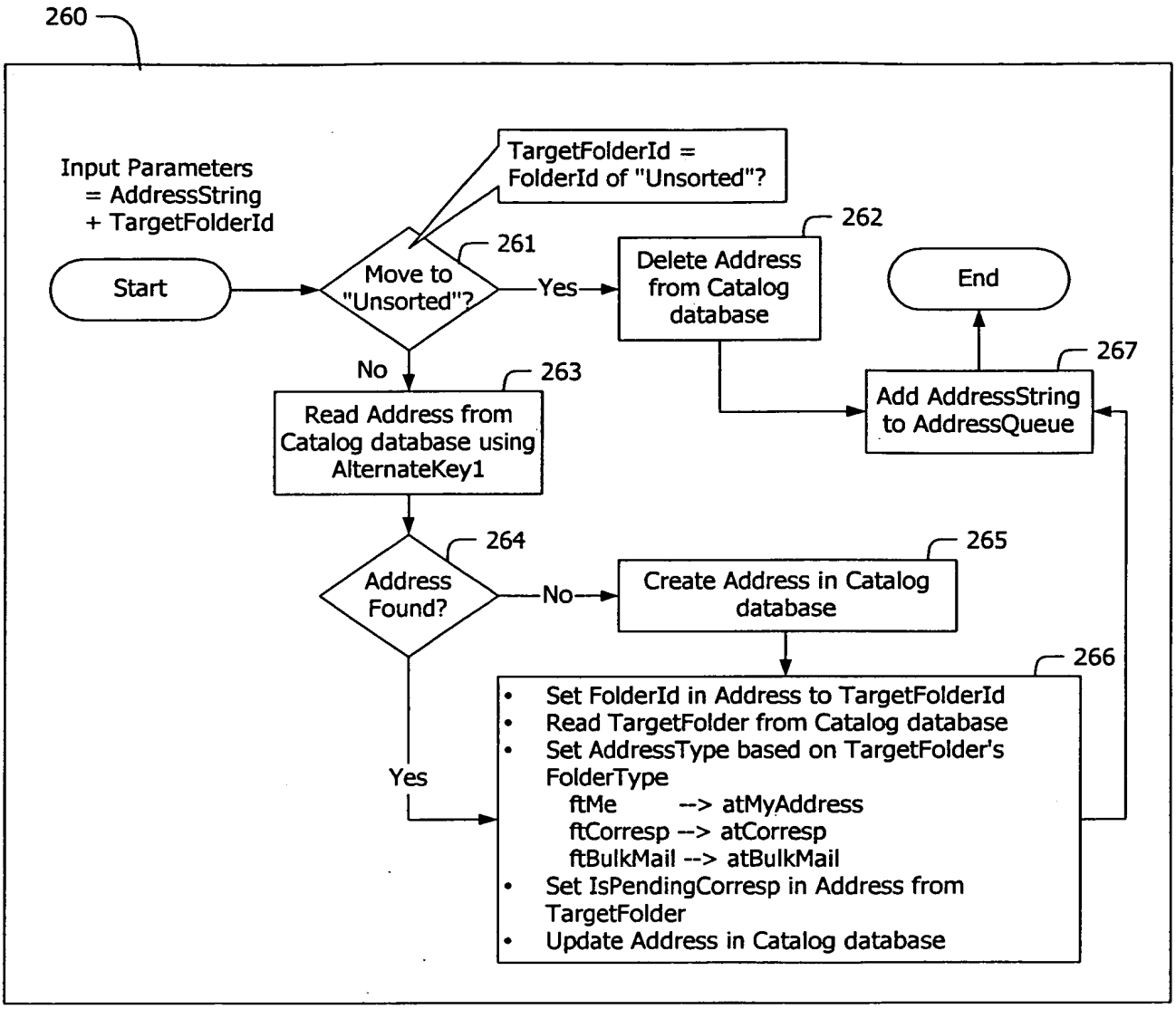

260
Input Parameters
= AddressString
+ TargetFolderId
Start
Move to "Unsorted"?
261
TargetFolderId = FolderId of "Unsorted"?
Yes
Delete Address from Catalog database
262
End
No
Read Address from Catalog database using AlternateKey1
263
Add AddressString to AddressQueue
267
Address Found?
264
No
Create Address in Catalog database
265
Yes
266
• Set FolderId in Address to TargetFolderId
• Read TargetFolder from Catalog database
• Set AddressType based on TargetFolder's FolderType
ftMe --> atMyAddress
ftCorresp --> atCorresp
ftBulkMail --> atBulkMail
• Set IsPendingCorresp in Address from TargetFolder
• Update Address in Catalog database

FIG. 26

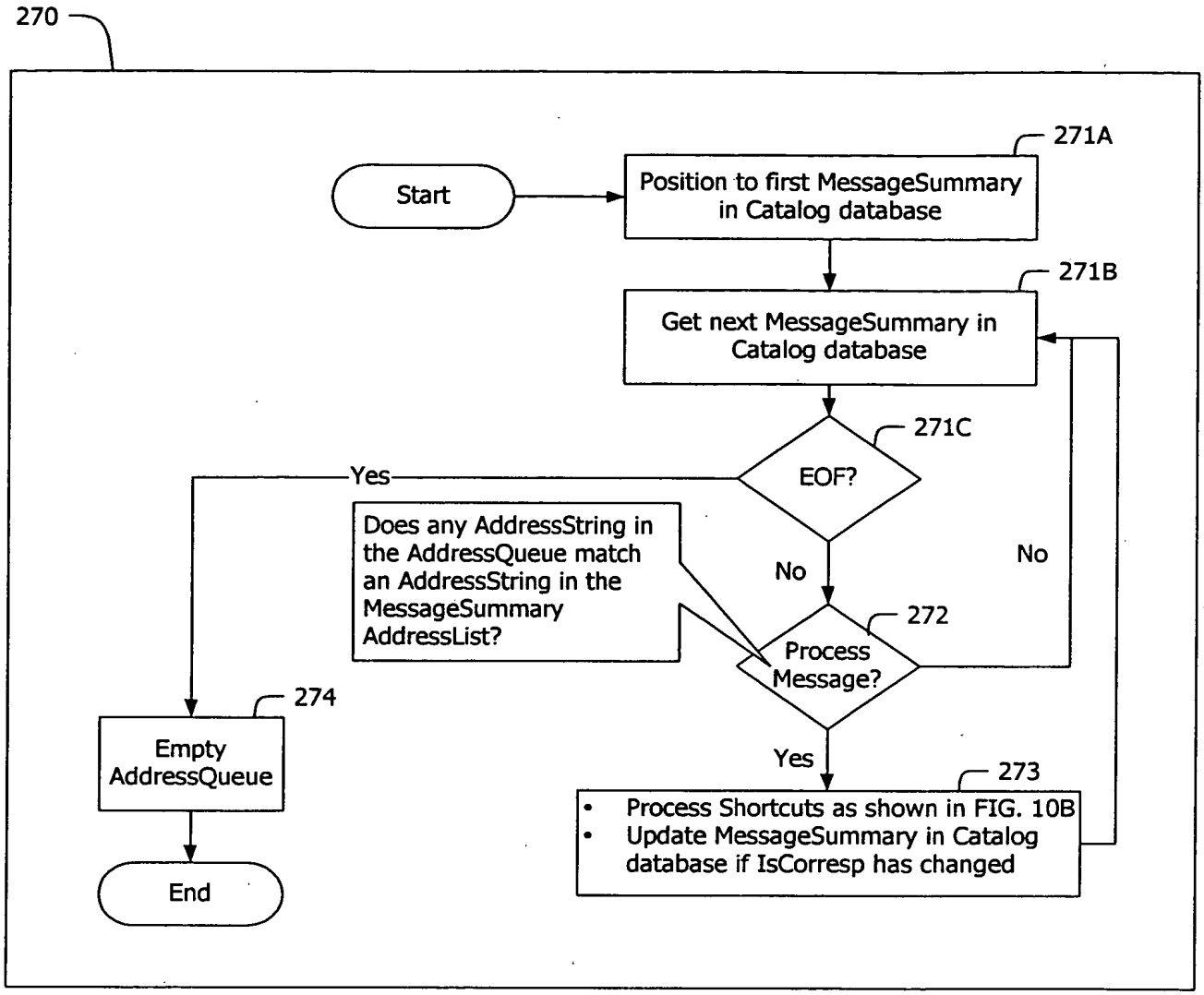

270
271A
Start
Position to first MessageSummary in Catalog database
271B
Get next MessageSummary in Catalog database
271C
EOF?
Yes
No
Does any AddressString in the AddressQueue match an AddressString in the MessageSummary AddressList?
No
272
Process Message?
Yes
273
• Process Shortcuts as shown in FIG. 10B
• Update MessageSummary in Catalog database if IsCorresp has changed
274
Empty AddressQueue
End

FIG. 27